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Subject:

Area 2/Otsego City Impoundment Supplemental Remedial Investigation/ Feasibility Study (SRI/FS) Work Plan

ENVIRONMENT

Dear Mr. Saric:

Date:
December 21, 2010

On behalf of Georgia-Pacific LLC (Georgia-Pacific), please find enclosed the final Area 2/Otsego City Impoundment SRI/FS Work Plan (Area 2 SRI/FS Work Plan). Additional copies have been provided to other recipients listed below. Approval of the Area 2 SRI/FS Work Plan was provided by the United States Environmental Protection Agency (USEPA) on December 1, 2010. We note your comment on the proposed Phase 1 sediment resampling activities and have made minor revisions to Section 4.2.2 of the Area 2 SRI/FS Work Plan to provide further clarification on why ARCADIS proposes to sample only the 0- to 2-inch interval. The revised paragraph is included below:

Contact:
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Our ref:
B0064529.00500

"Surface sediment samples (0- to 2-inch increment) are proposed to be collected from the approximately 22 sample locations originally sampled in 1993 and resampled in 2000 (Figure 4-1). The goal of this sampling is to ascertain whether or not changes in surface sediment PCB concentrations have occurred since 1993 given the passage of time and the construction of the removal action at the former Plainwell Impoundment. Further sediment sampling activities to collect full cores from other locations for analysis, including deeper intervals, is anticipated and will be performed during Phase 2 activities, described below. The re-sampling locations are specific to just those locations sampled twice previously.

At each of the targeted re-sample locations, a core will be collected by driving Lexan® tubing into the sediment until refusal, creating a vacuum, and retrieving the sediment. Each core collected will be photographed and described using the Uniform Soil Classification System (USCS). The upper 2 inches of sediment will be sectioned from the core and submitted for laboratory analysis of PCB Aroclors; TOC analysis and particle size distribution."

We look forward to working with USEPA, Michigan Department of Natural Resources and Environment (MDNRE), and the Natural Resource Trustees during the development and implementation of the SRI/FS for Area 2.

Sincerely,

ARCADIS



Michael J. Erickson, P.E.
Vice President

Enclosures:

2 Hard Copies

Copies:

Paul Bucholtz, MDNRE (1 hard copy)
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Allied Paper, Inc./Portage
Creek/Kalamazoo River
Superfund Site

Supplemental Remedial
Investigations/Feasibility
Studies

Area 2/Otsego City Impoundment SRI/FS Work Plan

Georgia-Pacific LLC

December 2010



**Allied Paper, Inc./Portage Creek/
Kalamazoo River Superfund Site**

**Supplemental Remedial Investigations/
Feasibility Studies**

**Area 2/Otsego City Impoundment
Supplemental Remedial
Investigation/Feasibility Study
Work Plan**

Georgia-Pacific LLC

December 2010



A handwritten signature in black ink, reading "Michael J. Erickson".

Michael J. Erickson, P.E.
Project Coordinator

**Area 2/Otsego City
Impoundment Supplemental
Remedial Investigation/
Feasibility Study Work Plan**

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Our Ref.:
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Date:
December 2010

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Acronyms and Abbreviations

AOC	Administrative Settlement Agreement and Order on Consent
ARS	Agricultural Research Station
BBL	Blasland, Bouck & Lee, Inc.
BERA	Baseline Ecological Risk Assessment
CDM	Camp, Dresser and McKee
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CRA	Conestoga-Rovers & Associates
CSM	Conceptual Site Model
DQO	Data Quality Objective
EPC	Exposure Point Concentration
EU	Exposure Unit
FS	Feasibility Study
FSP	Field Sampling Plan
HEC-RAS	Hydrologic Engineering Center River Analysis System
KRSG	Kalamazoo River Study Group
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDNRE	Michigan Department of Natural Resources and Environment
mg/kg	milligrams per kilogram
MHLLC	Millennium Holdings, LLC
NAD 83	North American Datum of 1983
NCP	National Contingency Plan

NGVD29	National Geodetic Vertical Datum of 1929
OSI	Ocean Surveys Inc.
OU	Operable Units
OU4	Operable Unit 4
OU5	Operable Unit 5
PCB	polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
RA	Risk Assessment
RI	Remedial Investigation
ROD	Record of Decision
SEDMOD	Sediment Transport Model
SME	Soil and Materials Engineers, Inc.
SOW	Statement of Work
SRI	Supplemental Remedial Investigation
TAL	Target Analyte Lists
TCL	Target Compound Lists
TIN	Triangular Irregular Network
TOC	total organic carbon
USCS	Uniform Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
1-D	one-dimensional

1. Introduction

On February 21, 2007, Georgia-Pacific LLC (Georgia-Pacific) and Millennium Holdings, LLC (MHLLC), also known as the Kalamazoo River Study Group (KRSG), voluntarily entered into an Administrative Settlement Agreement and Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA). This agreement, which describes a series of supplemental remedial investigations and feasibility studies (SRIs/FSs) that will be carried out over the next several years at the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (the Site or Superfund Site), is referred to as the SRI/FS AOC (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. V-W-07-C-864). The work performed under the AOC is to be consistent with the implementing regulations for CERCLA, known as the National Contingency Plan (NCP).

On February 5, 2009, MHLLC notified USEPA in writing that they would not be participating in any further work on the Site from that date forward, as a result of the Lyondell Chemical Company (Lyondell) bankruptcy. On April 23, 2010, the U.S. Bankruptcy Court approved Lyondell's reorganization plan. An outcome of the bankruptcy process was that Lyondell/MHLLC was released of responsibility for continued work on the Kalamazoo River by the United States in exchange for a cash settlement that included approximately \$100 million for Site-related work.

The Superfund Site is located in Kalamazoo and Allegan Counties and includes five operable units (OUs). Operable Unit 5 (OU5) includes a portion of Portage Creek and the Kalamazoo River (Figure 1-1). OU5 is divided into seven areas which are bounded by dams. Area 1 extends from Morrow Dam downstream to the remains of the former Plainwell Dam (the berm that had blocked the historical river channel was excavated as part of a removal action in the former Plainwell Impoundment in 2007 – 2009 [ARCADIS 2010a]). Area 2, which is the focus of this *Area 2/Otsego City Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan* (Area 2 SRI/FS Work Plan) extends from the location of the former Plainwell Dam to the Otsego City Dam.

1.1 Purpose of this Work Plan

This Area 2 SRI/FS Work Plan describes the supplemental investigations that will be completed to augment existing data to develop a SRI and FS and ultimately support a Record of Decision (ROD) for Area 2. USEPA's data usability determination (USEPA 2009), will guide use of existing data, together with the supplemental data.

The SRI work will include supplemental sampling and analysis of environmental media in the Kalamazoo River from the former Plainwell Dam to the Otsego City Dam to supplement existing data in the area and facilitate the development of the FS and ROD for this segment of the river. Results of the supplemental work summarized with previously collected data will be submitted to USEPA in an SRI Report for Area 2, followed by an FS Report. A substantial amount of data and information to support an SRI and FS already exist, and draft RI/FS reports that address Area 2 along with other parts of OU5 were previously prepared for the KRSG (Blasland, Bouck & Lee, Inc. [BBL] 2000a) and for USEPA (CH2M HILL 2003a, 2003b). USEPA's work included additional sampling of floodplain soils and preparation of a draft RI/FS for floodplain soils in OU5. The area has been the subject of a number of channel morphology and hydrologic studies by the United States Geological Survey (USGS) (Syed et al. 2004; Rachol et al. 2005; Wells et al. 2007). Additionally, a recent report by the Michigan Department of Natural Resources and Environment (MDNRE) (2010) summarizes observed relationships between polychlorinated biphenyl (PCB) distributions and channel geomorphologic features in the former Plainwell Impoundment, which also has relevance to design of supplemental studies of the Otsego City Impoundment. Water column PCB data and fish tissue PCB data have also been collected by the State of Michigan as part of long term monitoring activities (e.g., Camp, Dresser and McKee [CDM] 2009), and those data will be used in the SRI for evaluating fate and transport of PCB and PCB levels in fish for risk assessment purposes, as appropriate.

1.2 Objectives of Area 2 Supplemental Investigation

The supplemental investigation data to be collected as described in this Area 2 SRI/FS Work Plan will be used together with existing information to satisfy the requirements of AOC and Statement of Work (SOW) with respect to preparation of the SRI and FS reports. The specific objectives of the supplemental investigation described herein are to:

- Supplement the characterization of the nature and extent of PCB concentrations in sediments, river banks, and floodplain soils between the former Plainwell Dam and Otsego City Dam for purposes of the Area 2 SRI/FS, and to support human health and ecological risk assessments.
- Document the current physical conditions of the Kalamazoo River and its side channels and the river banks in Area 2.

The general requirements for Area-specific SRI/FS Work Plans are found in Section 1.3 of the SOW and include the following:

- Area Background (see Section 2 of this Work Plan)
- Multi-Area documents incorporated by reference, with Area-specific modifications as appropriate (noted throughout this Work Plan)
- A description of the tasks to be performed and information needed for each task (provided in Section 4)
- A description of the information to be produced through each task (provided in task descriptions in Section 4)
- A description of the work products to be produced and submitted for agency review (provided in task descriptions in Section 4 and the schedule of deliverables in Section 5)
- A schedule of activities (see Section 5.2)
- A project management plan (see the Quality Management Plan [ARCADIS, 2009a])

The specific Multi-Area documents to be used in implementing the Area 2 SRI/FS WP are:

- Generalized Conceptual Site Model (Generalized CSM) (ARCADIS 2009b)
- Risk Assessment Framework (RA Framework) (ARCADIS 2008a)
- Multi-Area Quality Assurance Sampling Plan (QAPP) (ARCADIS 2010b)
- Multi-Area Field Sampling Plan (FSP) (ARCADIS BBL 2007a)
- Multi-Area Health and Safety Plan (HSP) (ARCADIS 2007b)

The SOW also states that the Area-specific work plans are to describe an environmental program that is to include the following:

- Area reconnaissance (see Section 4.2.1)
- Geological investigation – Soil and Sediment (see Sections 4.2.1 through 4.2.3)
- Air Investigation – The USEPA-approved RA Framework (ARCADIS 2008a) does not include the air exposure pathway based on the results of prior air sampling investigations at the Site; therefore, no air investigation is planned for Area 2
- Hydrogeological (Groundwater) Investigation – At the SRI/FS Work Plan planning meeting on August 17, 2010, USEPA and MDNRE agreed that it was not necessary to include a hydrogeologic investigation in the Area 2 SRI/FS Work Plan
- Surface Water Investigation – Flow and hydrodynamic evaluations are described in Section 3.2.2; Surface water PCB sampling data collected as part of the State of Michigan's Long-Term Monitoring Program (CDM 2009) are also incorporated
- Geophysical Investigation – The geophysical investigation will include a remote topographic survey (see Section 3.2.1), inspection of sediment and soil core lithology, and use of soil borings during reconnaissance
- Ecological Investigation – Prior habitat assessments (described in Section 3.2.3) at the Site that have been approved for use by USEPA will be incorporated; endangered species will also be identified
- Disposal of investigation-derived waste – An Investigation-Derived Waste Management Plan is included as Appendix A of this Work Plan
- Evaluate and document need for treatability studies – A summary of the potentially beneficial treatability studies identified for the screened technologies was included in the *Multi-Area Feasibility Study Technical Memorandum: Evaluation of Candidate Technologies and Testing Needs* (ARCADIS, 2010c)

Data and other information relevant to certain scoping and characterization tasks listed above have been generated during prior investigations and documented in previously-submitted reports. These sources of data are referenced in this Work Plan where

appropriate. The specific data collection activities proposed to complete project scoping and characterization efforts are described in Section 4.

The SOW included as Attachment A to the SRI/FS AOC directs that new baseline human health and ecological risk assessments are to be prepared for each of the seven geographic Areas of OU5. The ultimate purpose of each Area-specific risk assessment is to support Area-specific risk management and remedial decision-making. The process for implementing the Area-specific risk assessments was established in the RA Framework (ARCADIS 2008a), which states that Area-specific risk assessment work plans will be prepared as a part of the SRI/FS process. Each Area-specific risk assessment is to build upon the information presented in the existing USEPA-approved risk assessments (CDM 2003a, b) and the Generalized CSM (ARCADIS 2009b).

Ideally, development of the Area 2 ecological risk assessment work plan will follow approval of the Area 1 Baseline Ecological Risk Assessment, and will potentially include additional information from ongoing studies, subject to USEPA concurrence. However, it is anticipated that the Area 2 ecological risk assessment will be substantially similar to the Area 1 ecological risk assessment, even if that draft report is still under review by USEPA. The RA Framework provides for flexibility in meeting risk assessment requirements on an Area-by-Area basis. For example, the RA Framework states that:

At a minimum, updated risk calculations are anticipated to be performed for each Area by incorporating more recent exposure data (e.g., new measurements of polychlorinated biphenyl (PCB) concentrations in soil, sediment, water, or fish). In conducting future Area-specific risk assessment work, the basis for changes from the CDM risk assessment methodology or inputs may also include the incorporation of new data, new science, new guidance, or new methodologies acceptable to USEPA that are current at the time each work plan is prepared.
(RA Framework, p. 1-1)

As in the Area 1 risk assessment, potential risks to human health will be recalculated on a Site-wide basis using the most recent available fish data at that time.

1.3 Document Organization

The remainder of this document is organized as follows:

- Section 2 provides Study Area background information.
- Section 3 describes previous investigation work and presents a CSM for Area 2.
- Section 4 identifies data needs, data quality objectives, supplemental investigation, and risk assessment tasks.
- Section 5 describes the Area 2 SRI/FS schedule.
- Section 6 provides references used in preparation of this document.

2. Study Area Background

Area 2, which lies between the former Plainwell Dam and the Otsego City Dam, includes the Kalamazoo River, its side channels, the floodplain, and the currently and formerly impounded areas (see Figure 2-1). CH2M HILL defined the Area 2 RI/FS Study Area in its 2003 RI/FS Report (CH2M HILL 2003a), and this boundary is incorporated as the SRI/FS Study Area boundary for the purposes of this SRI work. The boundary has been revised in the area of the 12th Street Landfill (the landfill is designated as Operable Unit 4 [OU4] of the Superfund Site) to be consistent with the boundary of excavation at the OU.

2.1 Physical Characteristics

The total length of Area 2 from the Otsego City Dam to the former Plainwell Dam is approximately 1.8 miles. The formerly impounded area behind the Otsego City Dam is approximately 1.7 miles in length (based on an approximate former dam pool elevation of 699 feet), measured along the centerline of the main river channel from the Otsego City Dam to a location downstream of the former Plainwell Dam. The area of the river that is currently influenced by the Otsego City Dam is approximately 1.2 miles in length (see Figure 2-1).

Beginning approximately 0.25 miles downstream of the former Plainwell Dam, the river is extensively braided. This continues for approximately 0.5 miles. Channel configuration has continued to change through time in this area (Figure 2-2) especially in response to changes in the dam structure. Approximately 13.5 miles of shoreline (which includes side-channel shorelines) are present in Area 2 as a result of the channel braiding.

Through Area 2, the river has an average water slope of 1.1 feet/mile and average bed slope of 2.4 feet/mile. The average water depth in the impoundment is 2.5 feet (BBL 2002). The average width of the main channel in the river is approximately 240 feet, and the maximum width of the upper braided section (measured between the edges of the outermost channels and across the channels in between) is approximately 1,300 feet.

The Gun River is a significant tributary of the Kalamazoo River and drains a large portion (approximately 107 square miles) of the Area 2 watershed. The Gun River flows through Allegan and Barry Counties consisting of agricultural land and urban

areas in Otsego Township. The Gun River enters the Kalamazoo River on the north bank about 0.45 miles upstream of the Otsego City Dam (Figure 2-1).

2.1.1 Sediment Deposits

USGS (Rheaume et al. 2004) provides a description of two types of sediment deposits located within the former Otsego City Impoundment: lacustrine deposits that accumulated after the dam was constructed and more recent alluvial deposits. When the water levels at the dam were lowered in the late 1960s (see drawdown history in Section 2.2.1), previously inundated areas were exposed and lacustrine deposits in the upstream areas were eroded by the river and transported downstream. In the upstream area of the former impoundment, increased slopes and river velocities exposed very coarse alluvium, characteristic of pre-dam conditions. Additionally, the dismantling of the upstream Plainwell Dam in the mid-1980s (Section 2.2.1) resulted in channel erosion of lacustrine sediments within the former Plainwell Impoundment. These mobile sediments from the former Plainwell Impoundment were redeposited within the channels of the upper section of the former Otsego City Impoundment resulting in additional braiding as main channels were filled and new channels were cut. After the channels stabilized, sand and gravel from upstream sources began to accumulate over lacustrine deposits within the impoundment (Rheaume et al. 2004).

Lacustrine deposits consist of interbedded, organic-rich silt and clay, fine to medium sand, and some gravel with thicknesses ranging from 0 to 7.5 feet. Alluvial deposits in Area 2 include sand bars and point bars and typically consist of sands and medium to coarse sand and gravel with traces of silt and clay. Thicknesses of these deposits range from 0 to approximately 3 feet in the main channel. A triangular irregular network (TIN) was developed based on the sediment probe information gathered by USGS (Rheaume et al. 2004) and KRSG field sampling efforts in 1993 and 2000. A TIN depicting top of sediment elevations (Figure 2-3) and another showing the sediment thickness (Figure 2-4) were prepared. These figures indicate a deeper, main channel through the central portion of the braided section, with shallower secondary braids. Figure 2-4 indicates limited sediment thickness in the upper portion of this main channel.

2.1.2 Bank Conditions

After the water level in the impoundment was lowered in 1982 and 1991 (see Section 2.2.1 for drawdown history), the exposed sediment banks became susceptible to undercutting and downstream transport due to increased river velocities, decreased

side-slope stability, and increased channel meandering (BBL 2000a). Exposed bank heights within the former Otsego City Impoundment range from 1 to 3 feet above the river surface. In comparison, bank heights in the other MDNRE-owned former impoundments on the Kalamazoo River are 2 to 3 times higher. Bank stability in Area 2 was modeled by USGS, and is described in further detail in Section 3. Although bank erosion measurements have been collected in the former Plainwell, Otsego, and Trowbridge Impoundments, no such measurements have been collected in the former Otsego City Impoundment. In the absence of data, CH2M HILL (2003a) assumed a level of PCB loading associated with bank erosion in the former Otsego City Impoundment, but emphasized the uncertainty associated with data limitations.

2.2 Otsego City Dam History

The Otsego City Dam, historically referred to as the Menasha Paper Company Dam, is located in the City of Otsego upstream of the Farmer Street Bridge. According to USGS, the Otsego City Dam was built in the 1840s in an effort to create a freight business on the Kalamazoo River (Dalrymple 1972, as cited in Rheaume et al. 2004). The original dam is reported to have been 5 feet high and contained a lock for the passage of barges, canoes, or rafts. The City of Otsego is the current owner of the dam structure.

Over the years, the dam has been rebuilt and repaired (Rheaume et al. 2002). In 2004, Soil and Materials Engineers, Inc. (SME) worked with the City of Otsego and various divisions of the Michigan Department of Environmental Quality (MDEQ) to design improvements and repairs to the dam, to which Georgia-Pacific provided partial funding. Construction efforts completed in 2004 on both the northern and southern sides of the dam included the installation of new sheet pile behind deteriorating masonry abutment walls and removal of the deteriorated walkway across the dam (SME 2007). After construction was completed, the City of Otsego observed two sinkholes near the northeast and northwest corners of the steel sheet pile wall and surface erosion around the sheet pile wall constructed on the south shore. It was concluded that the sinkholes were the result of settlement of fill and collapsing voids in the area and were backfilled by the City of Otsego (SME 2004).

2.2.1 Dam Operations and Drawdown History

Available information indicates that the water levels within the former Otsego City Impoundment were lowered in the 1960s (Rheaume et al. 2004). The water levels were further drawn down in mid-March 1982 when stoplogs were removed from the

dam (Hayes 1982), and again in May 1991 when the dam was dismantled to its sill level (Hayes 1991). The impact on water level due to the 1982 action is not known, but the Michigan Department of Natural Resources (MDNR) estimated that the 1991 action lowered water levels by 2 to 3 feet (Hayes 1991). The dam currently consists of a concrete gravity dam with three concrete piers located between four spillway bays and a capped masonry abutment at each end (Figure 2-1). All infrastructure associated with hydropower generation has been removed, and two previously-existing tailraces (one to the north and one to the south of the dam) have been filled (SME 2007). In its current condition, the dam creates a normal head of approximately 9.3 feet with an impoundment area of approximately 73 acres (SME 2007) and a 1.2 mile stretch of backwater in the formerly impoundment area (Rheaume et al. 2004).

The major releases of PCB to the Kalamazoo River began during the mid-to-late-1950s. Changes in the impoundment surface area have occurred since that time and are shown in a series of air photos from 1938, 1955, 1960, 1967, 1974, 1988, 1991, and 1999 in Figure 2-2. These aerial photos exhibit a variable extent of inundation behind the Otsego City Dam, which varied depending on the condition of the dam and river flows. The photos also indicate that the morphology of the braided channels in the upper portion of Area 2 has changed through the years and followed various paths through the floodplain.

Normal pool elevation of the Otsego City dam (after the drawdown in the 1960s) was 699 feet National Geodetic Vertical Datum of 1929 (NGVD29), which created a backwater extending approximately 1.7 miles upstream of the dam structure. The topographic contour at this elevation provides a bound on the area with relatively greater potential to have accumulated PCB due to long periods of inundation during the time period of PCB supply to the Kalamazoo River. This area is shown in Figure 2-1.

The historical aerial photographs indicate an approximate extent of PCB-containing sediments. In the study completed by USGS in 2001 and 2002, aerial photographs from 1938, 1967, 1988, and 1999 were used to create a visual timeline of the inundation area from the Otsego City Dam (Rheaume et al. 2004). For approximately 80 years, from when the dam was first constructed to 1938, impounded water levels were 2 to 4 feet higher than present impoundment levels. In the late 1960s water levels were lowered in the impoundment, as shown by the 1967 aerial. The 1988 aerial illustrates the changes to the river caused by the removal of the Plainwell Dam. Current conditions are shown in the March 2010 aerial (Appendix B). These aerial photographs can be used to approximate the extent of sediment deposited in the former impoundment that is now exposed (see Figure 2-1). As demonstrated by site

investigations in the former impoundments during the early 1990's, PCB distributions in the exposed sediments of the formerly impounded areas are predominantly a function of depositional processes during the period of impoundment when these areas were underwater.

The total acreage in Area 2 below the former Otsego City dam pool elevation of 699 feet NGVD 29 is approximately 231 acres. This former dam pool elevation was reported on the USGS topographic map of the area (USGS 1973). Much of this area is currently floodplain and /or wetlands and contains exposed sediments that were formerly submerged when the dam was operational —either for prolonged periods or short intervals depending on ground elevation and river flow fluctuations. Exposed sediments are present within a wide, relatively level vegetated floodplain area. The former Otsego City Impoundment currently contains approximately 76 acres of exposed sediment (Figure 2-1).

2.3 Property Ownership and Adjoining Areas

2.3.1 Dam Ownership

The Otsego City Dam is currently owned by the City of Otsego (SME 2007). Available information indicates it was originally purchased by Mr. Horace H. Comstock in 1832 and subsequently passed through various owners until Mr. William Mansfield took ownership in 1866. In 1885, the land south of the river which contained the dam and its appurtenances, except for the north abutment, was leased by Mr. Mansfield to Otsego Water Power Company for a period of 99 years for the purpose of hydropower generation. The land on the north side of the river, with the exception of the north dam abutment owned by William Mansfield, was owned by the Bardeen Paper Company at the time of the incorporation of the Otsego Water Power Company. The paper company property was then deeded to Menasha Wooden Ware Corporation (Menasha Corporation) in 1955. In February 1986, the General Manager of the Menasha Corporation Otsego Mill signed an affidavit that stated Menasha “claims no right, title or interest in the dam” (Buchanan 1986). According to a title search performed by Metropolitan Title Company in 1988, the dam was owned by both the City of Otsego (south shore of the dam) and the Menasha Corporation (north shore of the dam) (Pahl 1988). A subsequent title search conducted in 1998 by the same title company had the same outcome (Pahl 1998). This joint ownership continued through August 2005 when the Menasha Mill was closed. In early 2006, Otsego Paper Company, a subsidiary of US Gypsum Corporation (US Gypsum), purchased the property on the north shore of the dam and modified the paper making process equipment and is currently operating

the facility. Currently, dam ownership resides with the City of Otsego (SME 2007). The City of Otsego also currently owns the property on the south shore and Otsego Paper Company currently owns the north shore.

2.3.2 Parcel Ownership

The Allegan County parcel database was reviewed to identify parcel ownership in Area 2. A more detailed review was conducted by Miller Canfield to identify current ownership of islands in the braided section where the Allegan County parcel database information was unclear. Parcel ownership information as indicated by the Allegan County parcel database and the review by Miller Canfield (2010), is shown in Figures 2-5a and 2-5b.

The City of Otsego, along with the Douglas H. Dommert Trust, and Weyerhaeuser NR Company (Weyerhaeuser) are the major land owners in Area 2. The City currently owns several parcels designated as City of Otsego and Otsego Water Power Company. Weyerhaeuser is the responsible party for the 12th Street Landfill, which is situated on the river bank at the upstream end of Area 2, and owns the parcel that includes the 12th Street Landfill and property to the river (Figure 2-5b). No parcel information was available through the Allegan County parcel database for one parcel on the boundary between Otsego City and Otsego Township (Figures 2-5a and 2-5b), and Miller Canfield did not identify any relevant information for this area in their title search. This parcel is assumed to be owned by the City of Otsego, since the City owns surrounding parcels.

2.3.3 Adjoining 12th Street Landfill Operable Unit

As stated above, the 12th Street Landfill, OU4 of the Superfund Site, is located adjacent to the river at the upstream end of Area 2 (Figure 2-1) and is owned by Weyerhaeuser. The 12th Street Landfill is approximately 6.5 acres, and is bordered on the east by the former powerhouse discharge channel of the former Plainwell Dam, to the north and northwest by wetlands, to the southeast by woodlands, and to the west by a gravel mining operation. Land use in the vicinity of the 12th Street Landfill is characterized as industrial with asphalt recycling and cement facilities to the south and southwest. From 1955 to 1981, waste containing PCB generated at the Plainwell Paper Mill was disposed of in the wetland area by owners and mill operators— this disposal area is now identified as the 12th Street Landfill (USEPA 2001). The landfill contains an estimated 208,000 cubic yards of PCB-contaminated residuals, consisting of mineral in the form of gray kaolinite clay (USEPA 2001).

In addition to residuals, the landfill reportedly also accepted construction waste from the Plainwell Mill during part of its period of active operation (Conestoga-Rovers & Associates [CRA] 2010). It was reported that PCB was historically used in electrical equipment (transformers and capacitors) and hydraulic fluids at the Plainwell Mill (CRA 2009).

2.3.4 Adjoining Paper Company Operations

In 2007, Otsego Paper, a subsidiary of US Gypsum, implemented a bank stabilization project on the northern bank of the Kalamazoo River, both upstream and downstream of the Otsego City Dam. The effort was part of a Baseline Environmental Assessment, and involved removing bank material; clearing, grubbing, and reshaping the bank; and stabilizing the bank with geocell fill and riprap. River bank excavation extended approximately 2,400 feet upstream and downstream of the Otsego City Dam along the north bank of the impoundment (MDEQ 2007). The US Gypsum plant wastewater treatment facility is located north of the river adjacent to the floodplain of the former Otsego City Impoundment just upstream of the dam (Figure 2-1).

3. Previous Investigations

Area 2 has been the subject of a number of prior investigations and studies which are described in the following subsections.

3.1 Primary PCB Sampling and Geomorphic Studies

The primary prior investigations included PCB sampling and geomorphology studies. Prior sampling to characterize the nature and extent of PCB in Area 2 includes sampling events in 1993, 2000, and 2001. The primary existing geomorphology studies were conducted by the USGS. These sampling events included sediment and floodplain soil sampling and are briefly described below.

- **1993 RI Sediment and Floodplain Soil Investigation (KRSG)** – Exposed sediment and floodplain soil samples were collected from nine locations along a single transect in the former Otsego City Impoundment perpendicular to the river channel, and extending from the river bank to the edge of the 100-year floodplain. Sediment samples from 36 of the cored locations along the nine transects throughout Area 2 representing both fine and coarse material (see Figure 3-1) were collected and analyzed for PCB Aroclors. Selected samples were also analyzed for particle size, Target Compound Lists and Target Analyte Lists (TCL/TAL) analytes, and/or total organic carbon (TOC).
- **2000 Supplemental Investigation Sediment Sampling (KRSG)** – Sediment cores were collected from 47 locations within Area 2 generally overlapping with locations of cores collected in 1993 (Figure 3-1), and the upper one-foot (typically 0-2, 2-6, and 6-12 inch intervals) analyzed for PCB Aroclors. Selected samples were also analyzed for PCB congeners (analyzed by STL), particle size, and/or TOC. This sampling effort was conducted to provide an updated assessment of PCB distribution in the Kalamazoo River sediment that could be used to evaluate changes over time, to confirm the distribution of fine and coarse sediment observed in the RI sediment cores, to provide data to support sediment and PCB transport modeling analyses, to provide surface sediment data that correspond to coinciding fish and surface water data, and to delineate the PCB distribution in and transport characteristics of cohesive versus non-cohesive sediment and the spatial extent and distribution of both.
- **2001 Removal Assessment Sampling (USEPA)** – USEPA conducted a two-phased floodplain soil and sediment assessment in the former Plainwell and Otsego City

Impoundments. The first phase involved sampling on a systematic grid. In the second phase, a radial grid system was used by USEPA to sample around four of the Phase 1 boring locations exhibiting a range of PCB concentrations. These data are presented in the Removal Assessment Report prepared for USEPA by Weston (2002). Sample locations are shown on Figure 3-1.

- 2005 USGS Report: *Historical and Simulated Changes in Channel Characteristics of the Kalamazoo River, Plainwell to Otsego, Michigan*** – This report by Rachol et al. (2005) describes the general geologic and hydrologic conditions for the Kalamazoo River drainage basin. The report also assesses historical changes to the channel and bed slope based on interpretation of sediment core data collected by KRSG, additional transect survey information collected by USGS, and hydraulic modeling studies. No PCB data were collected as part of this study.

PCB data and other data from the investigations described above were utilized in the Draft Remedial Investigation Report and Feasibility Study prepared by CH2M Hill for USEPA (CH2M HILL 2003a), which addressed the floodplain soils within the former Plainwell and Otsego City Impoundments.

The number of existing sediment and soil locations and the number of samples analyzed for PCB are provided in Table 3-1 for each investigation. Figures 3-2 and 3-3 show the existing surface PCB results and core-maximum PCB results, respectively, for floodplain soil and sediment sample locations in Area 2. Note that in these figures, the classification of samples as sediment or soil (as designated by the sample matrix) does not appear to be consistent with their location in several instances. In preparation of these figures, some samples were reclassified (from the original matrix designation reported by USEPA) as soil or sediment (and Table 3-1 reflects the resulting current classification); however, in other cases insufficient information was available to fully support reclassification. A detailed review of individual sample classifications will be conducted for purposes of the SRI. Maps showing a data box for the PCB results for each available sample by depth interval are provided in Appendix C.

Table 3-1 Summary of Existing PCB Soil and Sediment Samples in Area 2

Sampling Event	Total Number of Locations	Total Number of PCB Samples Analyzed
Floodplain Soil		
1993 Floodplain Investigation	9	19
2000 Focused Sediment Sampling	10	34
2001 USEPA Phase I Sampling	31	129
2001 USEPA Phase II Sampling	47	296
Total	97	478
Sediment		
1993/1994 Sediment Investigation	36	115
2000 Supplemental RI Dam Sediment Sampling	47	133
2001 USEPA Phase I Sampling	31	134
2001 USEPA Phase II Sampling	87	318
Total	201	700

Note:

Upon receipt of sample data, USEPA sample SD030-25 was reclassified by ARCADIS from soil to sediment, and SD030-28 was reclassified by ARCADIS from sediment to soil based on inspection of aerial mapping in the locations of each sample.

A statistical summary of the PCB concentration data by sample type (sediment or floodplain soils) and sediment grain size (fine or coarse) is provided in Table 3-2. Cumulative frequency plots of PCB data are shown in Figures 3-4 through 3-6 for sediment and soil samples.

A total of 700 sediment samples have been collected from 201 locations within Area 2. Of these samples, 41% (288 samples) do not have PCB at detectable concentrations. More than 87% (610 samples) of all samples exhibited PCB concentrations less than 1.0 milligrams per kilogram (mg/kg) (Figure 3-4). Four percent of sediment samples exhibit PCB concentrations above 10 mg/kg.

The distributions of fine- and coarse-grained sediment samples (excluding USEPA samples), as shown in Figure 3-5, are similar in that approximately 90% of all samples from both distributions have concentrations less than 4.0 mg/kg and approximately 6% of PCB results exceed 10 mg/kg.

All floodplain soil samples in the southern portion of Area 2 (to the south of the Kalamazoo River, outside the 699-foot contour from the former dam pool elevation) have PCB concentrations less than 1 mg/kg. The median PCB concentration of all the

floodplain soil samples is 0.09 mg/kg, while the median surface soil concentration is lower; 0.037 mg/kg. Ninety-four percent of floodplain soil results are below 5 mg/kg, including 69.8% of surface and 91.5% of subsurface samples below 1 mg/kg (Figure 3-6).

3.2 Other Prior Data Collection and Studies

3.2.1 Bathymetry and Floodplain Topography Surveys

Available river bathymetry and floodplain topography data within the Study Area are summarized below.

- In 1993, 12 transects were established by BBL between the former Plainwell Dam and the Otsego City Dam (BBL 2002). Ninety-one probing locations were completed within the 12 transects. Sediment cores were recovered from 88 of the 91 probed locations and visually classified as either fine or coarse grained material.
- In November, 2000, a bathymetric survey and sidescan sonar survey were conducted by Ocean Surveys Inc. (OSI) in two portions of Area 2: 1) the main channel of the Kalamazoo River downstream of the upper braided section, and 2) a portion of the larger braided section on the southern side of the river. The maps and data obtained from this survey are included in Appendix D.
- Between 2001 and 2002, the USGS surveyed 85 transects across the Kalamazoo River between the former Plainwell Dam and the Otsego City Dam (Rheaume et al. 2004). Data points including water depth, water velocity, and sediment thickness were collected across each transect. Core samples were collected at one point along selected transects, generally where sediments were thickest. Lithologic descriptions of sediment cores were observed and recorded.
- In March 2010, Area 2 was flown by Axis Geospatial at the request of ARCADIS to develop updated orthographic aerial images through the area and provide detailed topographic information (1-foot contours) for the impoundment and surrounding areas (image and topographic maps are provided in Appendix B). Shaded contour intervals prepared from the March 2010 data are shown in Figures 3-2 and 3-3. This survey will be checked for accuracy by comparing the existing topographic information to spot elevations that will be taken as part of the floodplain sampling activities described in Section 4.

3.2.2 Hydraulic Models

Three one-dimensional (1-D) hydrodynamic/sediment transport models have been constructed describing the flow of water and sediment within the Kalamazoo River between the cities of Plainwell and Otsego (Syed et al. 2004; Rachol et al. 2005; Wells et al. 2007). USGS has provided ARCADIS with copies of each of these models:

- Syed et al. (2004) presents the results of a 1-D sediment transport model (SEDMOD) describing the sediment load and estimated volume of sediment erosion/deposition between the former Plainwell and Trowbridge Dams assuming both existing conditions and after removal of four Kalamazoo River dams (i.e., former Plainwell Dam, Otsego City Dam, Otsego Dam, and Trowbridge Dam).
- Rachol et al. (2005) presents a suite of model results, including Hydrologic Engineering Center River Analysis System (HEC-RAS), SEDMOD, and the Agricultural Research Station (ARS) Bank Stability Model, between Plainwell (North Main Street) and Otsego Township (Highway 89).
- The work of Wells et al. (2007) is similar to that of Rachol et al. (2005) in that similar channel geometry was used pre- and post-dam removal. However, Wells et al. (2007) used the CONCEPTS model, which incorporates bank stability and sediment transport into a single modeling framework and was run over a 37-year time frame compared to the 730-day span assessed by Rachol et al. (2005).

A hydraulic model will be prepared for Area 2 for use in the SRI and FS. The model will be prepared by enhancing one of the existing models after incorporating the more detailed topographic data obtained in March 2010 and updated transect bathymetry data (to be collected as described in Section 4) – or an equivalent two-dimensional model will be developed similar to that prepared for the former Plainwell Impoundment (ARCADIS BBL, 2007c).

3.2.3 Habitat Assessment

An ecological and habitat characterization assessment was completed in 2000 by ARCADIS (on behalf of the KRSG) that can be used to summarize the general habitat types in Area 2 (ARCADIS 2008b; Appendix S-3 to BBL 2000b). Based on the results of this assessment, which included a reconnaissance-level field survey of aquatic and terrestrial habitat and biota, the former Otsego City Impoundment contains emergent wetland adjacent to the river with smaller areas of shrub-scrub and forested wetland

intermixed. In addition, CDM was tasked by MDEQ to: 1) conduct wetland delineations for the purpose of confirming the existing NWI maps, and 2) delineate wetland boundaries within a portion of the Kalamazoo River and Portage Creek floodplains (CDM 2002). This delineation included the Otsego City impoundment area.

High resolution aerial photographs of this area taken in 2010 provide additional information concerning current habitat conditions in Area 2. The habitat information from the 2000 evaluation, CDM's 2002 delineation, and the 2010 aerial photographs, along with other relevant results, will be used to guide ecological risk assessment considerations, and will be included in the Area 2 SRI Report.

3.3 Preliminary Area 2 Conceptual Site Model

As described in the AOC, an area-specific CSM is included in this Area 2 SRI/FS Work Plan. The Generalized CSM (ARCADIS 2009b) provides an overall description of key aspects of OU5 (the Kalamazoo River and a section of Portage Creek, and associated floodplains). The RA Framework (ARCADIS 2008a) describes exposure pathways and receptors pertinent to Area 2. This area-specific CSM provides more detail with respect to the distribution and fate and transport of PCB in Area 2, and is based on information described in earlier sections of this work plan. This preliminary Area 2 CSM will be updated and expanded in the Area 2 SRI Report.

- There are two geomorphologically distinct subareas of Area 2 – the braided section and the formerly (and currently) impounded section. These subareas have different mechanisms of historical PCB accumulation and consequent current PCB distributions:
 - The braided section is the upstream section of Area 2, a portion of which is at elevations above the former dam pool elevation of 699 feet. The river flow through this area is divided among multiple channels. Flow velocities are relatively swift in the braided section, upstream of the extent of the current dam pool, and sediments are predominantly coarse-grained and of limited thickness. Fine sediment deposits in this area are anticipated to be of limited extent and associated with point bars, sand bars, and near-shore lower velocity areas.
 - The formerly impounded section is the lower section of Area 2, below the former pool elevation of 699 feet. Several side channels are present to the south of the main channel in the formerly impounded area. The area is characterized by a

broad low-lying floodplain in the middle part of the impoundment, which narrows nearer the dam.

- Mechanisms of historical PCB accumulation in the braided section and the formerly impounded section differ:
 - USGS scientists, including Rheaume et al. (2004), discuss the subsequent changes in the former Otsego City Impoundment associated with the dismantling of the upstream Plainwell Dam in the mid-1980s, which resulted in channel erosion of lacustrine sediments within the former Plainwell Impoundment that were redeposited within the channels of the upper section of the former Otsego City Impoundment. This resulted in additional braiding as main channels were filled and new channels were cut. After the channels stabilized, sand and gravel from upstream sources began to accumulate over lacustrine deposits. The altered channel hydraulics during this period may have given rise to non-typical river and floodplain interaction, with flows overtopping the banks due to flow constrictions associated with the new sediment deposits. The formerly impounded area was historically a more depositional environment due to reduced flow energy in the impoundment with decreasing distance upstream of the dam, where water depths were greatest.
- PCB distributions within the braided and formerly impounded section are influenced by the historic geomorphology and depositional mechanisms:
 - The braided section contains detectable levels of PCB in soils adjacent to the river in the reach immediately downstream of the restored 12th Street Landfill shoreline and the start of the former impoundment. It appears that higher soil PCB concentrations are associated with proximity to the main channel in this area. Sediments in the braided section are predominantly coarse-grained and of limited thickness. Available data suggest possible relationships between PCB concentration and depositional geomorphic strata within the braided sections, such as current point bars and historical channels that may have filled in.
 - Sediment in the formerly impounded area accumulated over the history of the impoundment, including the deposition of large volumes of sediment preceding the introduction of PCB to the Kalamazoo River. Periods of inundation, and thus PCB accumulation, varied depending on topography. Delivery and deposition of sediment and PCB within the floodplain and formerly impounded areas may have varied with distance from the river and depended on the degree and type of

vegetative cover. As a result of dam draw down, some areas of sediment have become exposed and are no longer in a submerged aquatic environment. Based on the existing data, most of the large areas of exposed sediment exhibit low PCB concentrations; the highest PCB concentrations tend to occur in close proximity to the banks of the existing channel. Main channel sediments contain relatively low PCB concentrations and exhibit the highest detected PCB levels adjacent to the river banks in relatively low velocity areas.

- Bank erosion processes in the former Otsego City Impoundment contribute PCB loading to the Kalamazoo River; but to a lesser extent than other formerly impounded areas due to the more limited degree of historical impounding and the more limited degree of dam draw down. Bank heights and nature and extent of PCB in Area 2 are similar to those observed in the Plainwell No. 2 Dam Area. Banks are relatively low, are more easily overtopped during flood events, and are less subject to undercutting than in other former impoundments. Bank erosion processes differ to some extent between the braided section and the formerly impounded section:
 - Bank erosion in the braided channel section may be occurring due to channel meander (as opposed to incisions of the sediment bed following dam drawdown in formerly impounded areas). The thickness of PCB-containing soils potentially subject to bank erosion in this area appears to be generally less than in the formerly impounded area.
 - Drawdown of the former Otsego City impoundment, as in other former impoundments, imparted increased flow energy and resulted in erosional bank conditions where the channel has incised the sediment bed and exposed former sediments comprise the current river bank.
- The available data indicate that PCB concentrations, magnitude of bank erosion, and extent of deposits with elevated levels of PCB are comparatively less than in the former Plainwell, Otsego, and Trowbridge impoundments.

4. Identification of Data Needs and Data Quality Objectives

The SOW requires that Area-specific data quality objectives (DQOs) be detailed in each Area-specific work plan. Principles of the DQO process described in USEPA (2006) guidance provide a guide for development of specific objectives to achieve this purpose. This is a seven-step planning process to ensure that the resulting data are of the appropriate type and quality for their intended use.

The seven steps and their application are described below.

Step 1: State the Problem

PCBs are present in Kalamazoo River fish tissue at levels deemed unacceptable for both ecological and human receptors. PCBs are also present in sediment, floodplain soils, and exposed sediments at potentially unacceptable levels.

The distribution of PCBs in the reach between the former Plainwell Dam and the Otsego City Dam has been documented as part of previous investigations –supplemental data are needed to provide an up-to-date and improved characterization of PCB in the Study Area in order to reduce uncertainty in assessing risks and evaluating potential remedial alternatives in the FS.

Step 2: Identify the Goals of the Study

The key goals of the investigation described in this Area 2 SRI/FS Work Plan are to provide up-to-date supplemental information to complete a SRI and a FS, and to support a risk assessment. Data collected as part of this Area 2 SRI/FS Work Plan will be used to:

- Determine current PCB exposure concentrations in soils and sediments in Area 2 for the risk assessments, and prepare the risk assessments.
- Describe the nature and extent of PCB in Area 2.
- Develop estimates of PCB mass present in soils and sediment in Area 2.
- Evaluate changes in surface sediment PCB concentrations in Area 2 compared to previous sampling events.
- Identify and evaluate appropriate remedial alternatives for the Area 2 FS.

Step 3: Identify Information Inputs

Information inputs to the SRI/FS will include the existing data and the supplemental data summarized below.

- Surface soil and surface sediment PCB concentrations will be used in the evaluation of potential risks in a manner consistent with the RA Framework (ARCADIS 2008a). This will include sediment type, location and extent of any significant fine sediment deposits, and PCB and TOC data representative of current conditions.
- Surface and subsurface soil and sediment PCB data will be used for PCB mass and PCB-containing soil and sediment volume inventory estimates.
- Historical and recent air photos and topographic maps will be used to describe locations and extent of pertinent geomorphologic features, and representative existing and supplemental data will be used to characterize PCB concentrations in those features. Pertinent geomorphic features may include categories or classification groups with similar physical and depositional characteristics that can be used to represent similar unsampled areas of Area 2, based on observed relationships between PCB concentrations and characteristics of targeted features. Sampling will be allocated more heavily to those features that are comparatively the largest with respect to spatial extent and thickness of former sediments, those judged most likely to contain disproportionately greater PCB concentrations and mass inventories, or those that are positionally available for remobilization by erosion.
- Existing and supplemental soil and sediment thickness data will be used along with existing topography data to refine maps of sediment and soil thicknesses and pertinent geomorphological features.
- Existing and supplemental bank soil PCB data will be used to estimate PCB distributions in the geomorphic features and in the Otsego City Impoundment as a whole.
- Existing and supplemental floodplain topography, bank and transect survey data, and hydraulic information from the available and/or updated hydraulic models will be used in conjunction with bank erosion pin survey data (to be collected under this Area 2 SRI/FS Work Plan) to develop estimates of bank soil and PCB erosion rates.

- Existing fish tissue data from recent sampling in 2009 together with prior data will be used to update human health risk calculations.
- Existing water column data from prior sampling by KRSG and the State of Michigan will be used to describe water column PCB concentrations and transport.
- Available information concerning sampling in the floodplain adjacent to the 12th Street Landfill will be used to describe current and expected conditions near and adjoining that OU on the parcel owned by Weyerhaeuser.

Step 4: Define the Boundaries of the Sampling

The geographic boundaries of Area 2 include the Kalamazoo River and the present-day floodplain between the location of the former Plainwell Dam and the Otsego City Dam, as defined in the 2003 RI/FS (CH2M HILL) and illustrated on Figure 2-1. The specific boundaries of the investigation areas will be defined in task-specific sampling plans to be developed in consultation with USEPA and MDNRE. Step 5: Develop the Analytic Approach

The analytic approach to complete the work described in this Area 2 SRI/FS Work Plan will incorporate both statistical hypotheses testing and estimation or other analytic approaches. The analytic approach includes, but is not limited to:

- Geostatistical evaluation of soil PCB concentrations within topographic elevation and/or identified geomorphologic strata to assess soil PCB concentration distributions within and among these strata.
- Statistical comparison of new surface sediment PCB concentrations to existing data to evaluate changes over time and the statistical significance of these changes.
- Calculation of updated soil and sediment PCB mass and PCB-containing soil and sediment volume inventories.
- Estimation of annual bank erosion PCB load.

Step 6: Specify Performance of Acceptance Criteria

Based on the potential uses of the data in the decision-making process, performance criteria and acceptance criteria will be equivalent to those associated with data collected

as part of the original RI (BBL 2000a), the 2000 Supplemental Investigations (BBL 2000b), and USEPA-approved work plans associated with Area 1 SRI activities. Data quality assurance/quality control will be managed as described in the Multi-Area FSP (ARCADIS BBL 2007a) and its associated addenda and Multi-Area QAPP (ARCADIS 2010b). Performance or acceptance criteria for data applications, such as statistical comparisons or trend analysis, will depend on the data results and variance of the data.

Step 7: Design Optimization

Implementation of the sampling activities will result in data that can be used to meet the objectives of the SRI/FS. Data gaps are identified and the rationale for specific phased field investigations is provided in Section 4.1, while specific sampling and analysis activities will be described in further detail in sampling plans to be developed for each phase for USEPA approval, following the practice for the series of sampling tasks designed and completed in collaboration with the Agencies in Area 1. The iterative and adaptive approach to data collection is provided for in USEPA DQO guidance, and is reflected in the phased study approach outlined in this Area 2 SRI/FS Work Plan.

4.1 Identification of Data Needs

Task 1.3.2 of the SOW requires an assessment of data gaps. Available data in Area 2 floodplain soil were sufficient to allow preparation of the Draft RI/FS prepared for USEPA by CH2M HILL (2003a, 2003b). Supplementing the available data to document current conditions and refine the characterization of the nature and extent of PCBs in the Study Area will reduce uncertainty associated with assessment of risks and evaluation of alternatives. Any data necessary beyond adequate characterization for RI/FS purposes is anticipated to be collected as part of pre-design investigations for the selected remedy. This Area 2 SRI/FS Work Plan provides for collection of the following supplemental data.

4.1.1 Survey and Reconnaissance

- Current river cross-section bathymetry throughout Area 2.
- Staff gage installation and water level recording.
- Locations, size, and general extent of fine-grained sediment deposits in the braided section.

- Locations, size and general extent of topographic low areas and/or historical depositional areas identified from topographic maps and historical aerial photos.
- Bank erosion rates.

4.1.2 Sediment

- Current surface sediment PCB concentrations throughout Area 2.
- Sediment PCB concentrations representative of specific geographic areas (channel braids, impounded area, back water areas) and geomorphic features (near-shore sediment deposits, point bars, etc.) of Area 2.

4.1.3 River Bank and Floodplain Soil

- Soil PCB concentrations representative of specific geographic areas and geomorphic features of Area 2.
- PCB concentrations in floodplain soils representative of elevation strata and/or historical depositional strata within the formerly impounded area and low-lying areas of the floodplain in the braided section where spatial coverage is low.
- PCB concentrations in floodplain soils in areas proximate to the bank of the main channel upstream of the formerly impounded area where floodplain deposition may have occurred in low lying areas proximate to the main channel during the period of increased braiding following the former Plainwell Dam drawdown (see prior discussion in Section 3), and where spatial coverage is low.
- PCB concentrations from bank soil samples representative of bank types along the main channel and in the braided channels.
- Bank types and stability conditions throughout Area 2.

4.2 Sampling Activities to Meet DQOs

Sampling activities will be conducted in one or more investigation phases:

4.2.1 Survey and Reconnaissance

All survey work will be conducted using conventional survey methods or global positioning system equipment, as conditions warrant. Both methods will provide horizontal coordinates and vertical elevations with an accuracy of approximately 0.1 foot. Survey data will be provided in terms of State Plane Michigan South Zone, North American Datum of 1983 (NAD 83), International Feet and NGVD29.

Phase 1

- A subset of the previously surveyed channel cross sections in the main and braided section will be re-surveyed to evaluate changes since the prior surveys. In addition, 35 new supplemental transects will be established and surveyed. At each new transect, sediment cores will be collected by driving Lexan® tubing into the sediment until refusal, creating a vacuum, and retrieving the sediment intact for visual characterization. Sediment cores will be collected at approximately eight to ten locations at intervals between the two opposite banks. At each core location, the depth of water and the sediment thickness will be measured, the characteristics of the sediment will be noted, and the geographic coordinates and elevation will be determined to an accuracy of approximately 0.1-foot. The water surface elevation will be surveyed once during the survey activities at each transect (existing and new transects). Sediment cores will be opened and described with regard to sediment lithology and material. If changes in the re-surveyed transects since the initial survey are significant, additional transects will be re-surveyed in a second phase of survey work, if determined to be necessary.
- To characterize bank conditions, bank profiles will be surveyed at locations along the main channel and the channel braids. Detailed bank profile elevations will be recorded from the top-of-bank down to the river bed. The top-of-bank, the slope-of-bank, and the toe-of-bank under the surface of the water will be surveyed, as well as any grade changes and at least one point beyond the top-of-bank to reflect the general topography of the floodplain (see Figure 2-1). Survey on the landward side of the bank profile will extend to 30 feet from top-of-bank to tie into the aerial survey topographic data described in Section 3.2.1.
- A number of elevations will be surveyed at the Otsego City Dam to confirm the existing spillway and abutment elevations.

- Staff gages will be installed at up to three locations to be determined in the field near the Otsego City Dam and downstream of the location of the former Plainwell Dam, and, depending on ease of access, near the mid-point of Area 2. A series of water level readings will be collected across a range of flow conditions opportunistically during the various SRI field activities. In conjunction with each set of water level readings, a flow measurement will be taken at the Farmer Street Bridge just downstream of the Otsego City Dam.
- Locations of potential fine-grained sediment deposits within pertinent geomorphological features in the river and floodplain will be identified from the high resolution aerial photos of Area 2 obtained from the flyover in March 2010 (Appendix B), and a draft figure identifying the general characteristics and potential extent of target areas for sampling will be prepared for review and discussion with the Agencies, prior to reconnoitering each target area in Phase 2.
- Locations and general characteristics of topographically low areas and pertinent geomorphological features, including potential historical depositional areas will be preliminarily identified using the high resolution digital elevation map and aerial photos of Area 2 obtained from the fly over in April 2010 (Appendix B), and historical aerial photos, an example set of which is shown in Figure 2-2. This identification will consider the frequency and duration of inundation of areas of the impoundment, the nature of inundation (i.e., flooding, standing water, flowing water, and water storage), the historical movement and filling in of channels and development of braids, and type of vegetative cover. A draft figure will be produced from this effort that delineates and describes potential “strata of interest” for sampling (based on previous focused sampling guided by MDNRE, e.g. MDNRE’s 2010 *Geomorphic Feature Delineation and PCB Correlations in the Former Plainwell Impoundment* report). This figure will be shared for review and discussion with the Agencies. These strata will be ranked by likelihood of having accumulated PCB, based on the factors previously described in Section 4, Step 3 of the DQO process.
- In conjunction with work to be completed by ARCADIS pursuant to this work plan, USEPA FIELD5 group plans to perform a bathymetric survey in the portions of the Kalamazoo River and its braided channels in Area 2 that are accessible by boat and of adequate depth to utilize the FIELD5 group survey equipment. ARCADIS will coordinate with the FIELD5 group to prepare a survey plan. If this survey is conducted by FIELD5, ARCADIS will obtain and incorporate results of the survey in the Area 2 SRI Report.

Phase 2

- In Phase 2, field reconnaissance will be conducted to prepare a final figure delineating targeted “strata of interest” for use in preparing a sampling approach to collect representative data from these strata, as described in Phase 1 sediment sampling activities. Strata of interest will be identified based on professional judgment, considering: the history, frequency, and period of inundation; type and density of vegetation; and proximity to main river channel, as described in the Phase 1 activities. Potential strata include, but are not limited to:
 - Alluvial sediment deposits (near shore deposits, points bars)
 - Lacustrine deposits near the Otsego City Dam
 - Mid-channel sediment
 - Braided channels and numerous islands
 - Former marsh and existing marsh areas
 - Upland floodplain

Existing PCB data will be used to characterize strata as an *a priori* consideration for future sampling. Based on the existing information, proposed sample locations will be allocated with consideration to the relative size and occurrence of a given stratum and the likelihood that a stratum will contain fine-grained sediment or PCBs. Relatively lower sample spatial density will be allocated within strata judged less likely to contain fine-grained sediment. Areas with limited data adjacent to the main channel upstream of the extent of the former impoundment will also be reconnoitered to guide design of a sampling approach to further characterize potential floodplain deposits along the banks in this area. This field reconnaissance step is anticipated to occur during late winter or early spring before vegetation emerges and before significant rainfall occurs.

- Additional existing transects will be surveyed, if deemed necessary as an outcome of the Phase 1 survey and after consideration of the bathymetric data to be collected by the USEPA FIELDs group.

4.2.2 Sediment Sampling

Phase 1

- Surface sediment samples (0- to 2-inch increment) are proposed to be collected from the approximately 22 sample locations originally sampled in 1993 and resampled in 2000 (Figure 4-1). The goal of this sampling is to ascertain whether or not changes in

surface sediment PCB concentrations have occurred since 1993 given the passage of time and the construction of the removal action at the former Plainwell Impoundment. Further sediment sampling activities to collect full cores from other locations for analysis, including deeper intervals, is anticipated and will be performed during Phase 2 activities, described below. The re-sampling locations are specific to just those locations sampled twice previously.

- At each of the targeted re-sample locations, a core will be collected by driving Lexan® tubing into the sediment until refusal, creating a vacuum, and retrieving the sediment. Each core collected will be photographed and described using the Uniform Soil Classification System (USCS). The upper 2 inches of sediment will be sectioned from the core and submitted for laboratory analysis of PCB Aroclors; TOC analysis and particle size distribution.

Phase 2

- A sampling plan for fine-grained sediment deposits will be prepared for USEPA approval based on the final figure of target areas developed through the survey and reconnaissance activities described above. This plan will provide for sampling fine-grained sediments within the target areas and other sediments outside of these areas such that the total sample count provides approximately 75% fine sediments and 25% coarse sediments and also geographically-representative samples. Field parameters and visual classification of samples may be used to define sub-strata of fine sediment to collect data sufficiently representative of those strata. Some random sampling may also be included outside of the strata of interest to assess or confirm PCB levels in areas believed unlikely to contain elevated PCB concentrations. The full approach will be described in the sampling plan for USEPA approval. This will provide PCB data representative of fine-grained sediments in target areas and other main-channel sediments. At each of the targeted locations, a core will be collected by driving Lexan® tubing into the sediment until refusal, creating a vacuum, and retrieving the sediment. Each core collected will be photographed and described using the USCS. The core will be sectioned into the 0- to 2-inch increment, the 2- to 6-inch increment, the 6- to 12-inch increment, and subsequent 1-foot increments to the bottom of the core. Sectioning will be varied as necessary to capture visually-distinct strata, where present. All samples will be submitted for laboratory analysis of PCB Aroclors; surface samples will also be submitted for TOC analysis and particle size distribution. (Note: Whereas all sample depth intervals were analyzed for TOC and particle size distribution in several of the Area 1 SRI investigative tasks, subsurface TOC and particle size data has not been consequential to design of

subsequent phases of study or removal actions in the case of the Plainwell No. 2 Dam Area project – although approximately 94 percent (47 of 59) of the samples were analyzed for particle size and TOC, were subsurface samples. On that basis, a subset of approximately 20% of the sediment cores to be collected in this task will be analyzed for particle size distribution and TOC over the entire core (i.e., all depth increments).

4.2.3 Bank and Floodplain Soil Sampling

- A floodplain soil sampling plan for the “strata of interest” will be prepared for USEPA approval. This plan will be designed to provide representative data when existing and supplemental samples are combined and will provide relatively fewer total samples within strata ranked as having the least likelihood of having accumulated PCBs. In areas where existing PCB data are available, they will be used to characterize final strata as an *a priori* consideration to future sampling. Based on the existing information, proposed sample locations will be allocated with consideration to the relative size and occurrence of a given strata and the likelihood of a strata to contain fine-grained sediment (or PCB). This plan will also include proposed sample locations adjacent to the main channel upstream of the formerly impounded area to supplement existing data, where presently limited in spatial coverage.
- The floodplain soil sampling plan will also include a top-of-bank soil sampling component. Sample locations will be selected collaboratively with USEPA and MDNRE and will be based on consideration of bank types and geomorphology of the former impoundment. It is anticipated that most sampling locations will coincide with bank erosion pin survey locations. Soil samples will be collected from the top of the river bank at locations outlined in the sampling plan to be submitted to USEPA to characterize the nature and extent of PCBs in bank soils and estimate PCB loadings from bank erosion. Bank soil cores will be targeted primarily along the main channel of the Kalamazoo River and with less spatially intensive, but perhaps more focused sampling in the side channels. Soil cores will be collected in accordance with the Multi-Area FSP (ARCADIS BBL 2007a). Soil cores will be photographed, described, segmented into the 0- to 6-inch increment, 6- to 12-inch increment, and subsequent 1-foot increments to the bottom of the core. Sectioning will be varied as necessary to capture visually-distinct strata, where present. All samples will be submitted to the laboratory for PCB Aroclor analysis. The surface sample from each core will also be analyzed for TOC and particle size distribution.

- In addition to the data considerations described above, the floodplain soil sampling plan will also be developed considering specific risk assessment data needs as described below in Section 4.3. If additional data needs are identified for risk assessment, any proposed additional data collection will be included in the floodplain soil sampling plan for USEPA review and approval.
- Based on the approved sampling plan, soil samples will be collected at the established locations. Soil cores will be collected in accordance with the Multi-Area FSP (ARCADIS BBL 2007a) and associated addenda. Soil cores will be photographed, described, segmented into the 0- to 6-inch increment, 6- to 12-inch increment, and subsequent 1-foot increments to the bottom of the core. Sectioning will be varied as necessary to capture visually-distinct strata, where present. All samples will be submitted to the laboratory for PCB Aroclor analysis. The surface sample from each core will also be analyzed for TOC and particle size distribution.

4.2.4 Erosion Pin Study

The exposed sediment which now comprises the existing river banks within the Otsego City Impoundment may potentially be a source of PCB to the Kalamazoo River. To assess the rate at which sediment, and potentially PCB, are being contributed to the river, erosion pins will be installed at several locations to measure bank movement over time. Specific objectives of erosion pin placement are:

- To estimate the rate of bank erosion across the various bank types.
- To estimate the volume and mass of solids and PCB contributed by the banks to the river on an annual basis.
- To monitor changes in the channel shape and bank configuration over time.

The measurement of erosion rates will be accomplished through the installation and survey of a series of pins as a stationary baseline and monitoring the changes in bank and channel topography over time at the pins. Erosion pins will be placed at both ends of established bank-to-bank sediment transects to represent a variety of conditions ranging from little expected erosion to relatively high erosion potential. Planned erosion placement pin locations are shown in Figure 4-2. Final locations will be determined based on the results of the upcoming bank survey and will account for representative bank types and materials as well as expected erosion potential.

At each erosion pin placement location, a series of survey pins will be installed flush with the ground surface. The survey pins will be placed in three individual straight lines, 20 feet apart, perpendicular to river flow. In each line, individual survey pins will be placed at the top-of-bank, and at 5, 10, 15, and 25-foot distances from the first pin. This will result in 15 pins at each erosion pin location. Each survey pin location will be surveyed using conventional ground survey methods, which typically have an accuracy of approximately 0.1 feet horizontally and 0.1 feet vertically. After the survey pins are placed on the top-of-bank and extending away from the river, the straight line will be projected into the river. The bottom-of-bank in the river will be identified, and the location and elevation will be surveyed. Between the bottom of the bank and the top-of-bank survey pins, five additional locations, equally spaced, will be surveyed, as well as one location 5 feet further into the river from the bottom-of-bank. This will result in seven surveyed locations within the channel along each survey line planned to be surveyed, but not marked with survey pins (21 survey points for each erosion pin location).

At each location, the general area of erosion pin placement, as well as the river bank above the waterline, will be photographed. Each individual bank transect will be sketched in a field notebook, and the location of the edge of water will be noted. These activities will be completed during the bank survey task, but supplemented at the time of erosion pin installation if new locations are selected that were not previously surveyed.

Erosion will be measured using the erosion pins by resurveying the bank along each transect periodically. Resurvey will be performed every six months for up to two years; after that, the need to continue will be re-assessed. During resurvey, the pins in the floodplain will be used to extend the transect into the river. The bank configuration, from the top-of-bank to beyond the bottom-of-bank, will be re-measured in the same way as the initial survey. All survey points will be georeferenced to the established erosion pins. If the top-of-bank pin has eroded, a new pin will be installed at the new top-of-bank and surveyed.

Rates of erosion (or deposition) will be estimated by dividing the distance of bank retreat by the time between measurements. The volume and mass of eroded material will be derived by calculating the cross-sectional differences between the bank profiles over time, in conjunction with soil properties determined during the former impoundment investigation. By using the three erosion pin transects per location, localized spatial variations in erosion characteristics may be estimated. Furthermore, the change in channel shape or slope may be estimated; for example, if the river is getting wider and shallower, this will be detected over time.

4.3 Risk Assessment

4.3.1 Ecological Risk Assessment Data Needs

Consistent with agreements reached with USEPA for Area 1, the Area 2 Baseline Ecological Risk Assessment (BERA) will be conducted only for the floodplain areas of the former impoundment. The conclusions for the in-stream aquatic environment provided in the CDM BERA (CDM 2003a) will be carried forward for the in-stream portions of Area 2. The approach for conducting the Area 2 BERA will follow the methodologies described and approved in the *Area 1 Work Plan Supplement: Baseline Ecological Risk Assessment Work Plan* (Area 1 BERA WP; ARCADIS 2010d). Specifically, the assessment and measurement endpoints, representative receptors and associated exposure parameters, and the exposure models described in the Area 1 BERA Work Plan will be used as applicable for Area 2. Based on the approaches outlined for Area 1, it is expected that supplemental floodplain soil sampling data will provide the necessary additional data for conducting the BERA for Area 2.

To identify floodplain soil data needs for risk assessment, it is anticipated that an approach will be used to develop exposure units (EUs) and exposure point concentrations (EPCs) for the identified receptors that is very similar to the approach developed for Area 1. If appropriate, and with consensus of USEPA, a work group may be convened to determine the specific approach for Area 2 after review of the supplemental data (to be collected pursuant to this Work Plan) together with existing data. Spatial data needs specific to the BERA will be considered when the floodplain soil sampling plan is developed, as described in Section 4.2.3.

4.3.2 Human Health Risk Assessment Data Needs

Consistent with the approach taken for Area 1, new human health risk assessment work carried out as part of the Area 2 SRI/FS will be limited to preparation of updated risk estimates for fish consumers. These updated risk estimates will be based on the most recent Site-wide measurements of PCB concentrations in fish tissue available at the time the Area 2 SRI Report is prepared. Given the limited scope of these activities, a separate baseline human health risk assessment report will not be prepared for Area 2; instead, the updated risk estimates will be appended to and discussed within the Area 2 SRI Report.

5. Reporting and Schedule

5.1 Progress Reports

As described in the AOC and SOW, monthly written progress reports will be submitted to USEPA and MDNRE to describe the status of the project. The Area 2 activities pursuant to this Area 2 SRI/FS Work Plan will be documented as part of the monthly progress reports that are regularly submitted for Area 1 work.

In addition to the monthly progress reports, a Semi-Annual Progress Report will also be submitted and will describe work in both Area 1 and Area 2.

Both the monthly and semi-annual progress reports will be submitted until the termination of the AOC, unless otherwise directed by USEPA.

5.2 Schedule

The SRI/FS schedule will accommodate the requirements of the AOC.

It is anticipated that field activities will be completed in phases, as described in Section 4. The timing of field activities will be contingent on USEPA approval of sampling plans, completion of necessary access agreements, seasonal weather conditions, and completion of subsequent phases where specific sampling approaches are to be guided by data initially collected.

As described in the AOC, USEPA and MDNRE will be notified of planned field activities at least fifteen (15) days prior to conducting significant field events, but to the extent possible, specific schedules will be included in each sampling plan submitted to USEPA for review and approval. Field activities will be scheduled to avoid/minimize late fall and winter work to reduce safety risks related to cold weather work and the risks associated with the significant hunting activity that occurs in and along the floodplains of the Kalamazoo River during the late fall and early winter. If deviations from the submitted/approved schedules are deemed prudent due to safety issues or other concerns, Georgia-Pacific and ARCADIS will submit an updated schedule to USEPA for review and approval along with the rationale for the request.

The Draft Area 2 SRI Report will be submitted for USEPA and MDNRE review six months following the last sampling event.

Table 5-1 outlines the submittals and key milestones that are currently anticipated as part of the Area 2 SRI/FS activities.

Table 5-1 Summary of Key Area 2 Submittals and Milestones

Submittal/Milestone	Estimated Schedule	Estimated Date
Revised Draft Work Plan Submittal	60 days from direction to modify	October 26, 2010
Work Plan Approval by USEPA	4 weeks after Work Plan submittal	November 23, 2010
Access Agreements Completed	45 days from Work Plan approval	January, 2011
Sediment Coring/Reestablishment of USGS Transects	To commence following completion of access agreements	March 2011
Installation of Erosion Pins and Staff Gages	To commence following completion of access agreements	March 2011
Prepare Bathymetry Survey Plan with USEPA FIELDs Group	90 days from Work Plan approval	February 2011
Identification of Strata for Reconnaissance (Sediment, Bank, and Floodplain Soils) – Draft for USEPA and MDNRE review	60 days from Work Plan approval	January 21, 2011
Meeting/Call to review Draft Strata, discuss Reconnaissance Plan and Schedule	30 days from Submittal of Draft Strata Plan	February 21, 2011
Submittal of Revised Strata Map / Reconnaissance Plan to USEPA	15 working days after Meeting to discuss Draft Strata Plan	March 14, 2011
Field Reconnaissance and Bank and Transect Survey	30 days to Mobilize, Complete Fieldwork, and Document	March/April 2011
Bathymetry Survey by USEPA FIELDs Group	–	March 2011
Draft Phase 2 (Sediment, Bank, and Floodplain Soils) Sampling Plan based on Reconnaissance for USEPA and MDNRE review	60 days after Reconnaissance is Complete	June 2011

Submittal/Milestone	Estimated Schedule	Estimated Date
Meeting/Call to review Draft Phase 2 Sampling Plan	30 days after Draft Phase 2 Sampling Plan Submittal	July 2011
Final Phase 2 Sampling Plan	30 days after Meeting and Agency Comments on Draft Phase 2 Sampling Plan	August 2011
USEPA approval of Phase 2 Sampling Plan	2 weeks after submittal of Phase 2 Sampling Plan	September 2011
Soil and Sediment Sampling	30 days after USEPA Approval of Phase 2 Sampling Plan	September/October 2011
Laboratory Analysis and Validation	60 days from Completion of Sampling	December 2011
Sampling Results Summary and Maps for Agency Review	60 days from Completion of Sample Validation	February 2012
Meeting to Review Data Summary and Determine Adequacy for Area 2 risk assessment and RI	30 days from Agency Receipt of Data Summary	March 2012
Contingent schedule for additional field work and/or SRI and risk assessment report planning meetings	60 days	March, April, May, 2012
Preparation and Submittal of Draft Area 2 risk assessment and SRI Report for Agency Review	Within 6 months following receipt of all sample data, not later than Due Date.	Draft SRI Report Due Date: November 1, 2012*
Preparation and Submittal of Area 2 Alternatives Screening Technical Memorandum	60 days from Submittal of SRI Report	December 2012
Receipt of Agency comments on Area 2 Alternatives Screening Technical Memorandum	60 days from Submittal of Area 2 Alternatives Screening Technical Memorandum	March 2013
Submittal of Draft FS Report for Agency Review	90 days after receipt of Agency comments on Area 2 Alternatives Screening Technical Memorandum	May 2013

* If the timing of agency review and approval schedules throughout 2011 and 2012 result in an overall schedule that prevents a reasonable time period for preparation of the Draft SRI Report, with USEPA approval, the project team will collaborate to revise the November 2012 due date .

In summary, the following planning materials will be provided to USEPA as part of the development of the Area 2 SRI Report:

- Draft figure identifying strata for reconnaissance (sediment, bank, and floodplain soils)
- Reconnaissance plan, including final figure identifying strata for reconnaissance (sediment, bank, and floodplain soils)
- Draft Phase 2 Sampling Plan (sediment, bank, and floodplain soils)
- Final Phase 2 Sampling Plan (sediment, bank, and floodplain soils)
- Sampling results summary and maps
- Draft Area 2 BERA and SRI Report

6. References

- ARCADIS. 2008a. *Risk Assessment Framework for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*. June 2008.
- ARCADIS. 2008b. *Supporting Document for Ecological Risk Studies Peer Review, Characteristics of the Formerly Impounded Areas*. May 2008.
- ARCADIS. 2009a. *Quality Management Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*. May 2009.
- ARCADIS. 2009b. *Generalized Conceptual Site Model for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Generalized CSM)*. May 2009.
- ARCADIS. 2010a. *Former Plainwell Impoundment Time-Critical Removal Action Final Construction Completion Report*. March 2010.
- ARCADIS. 2010b. *Multi-Area Quality Assurance Project Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Multi-Area QAPP)*. March 2010.
- ARCADIS. 2010c. *Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. Multi-Area Feasibility Study Technical Memorandum: Evaluation of Candidate Technologies and Testing Needs*. March 2010.
- ARCADIS. 2010d. *Area 1 Work Plan Supplement: Baseline Ecological Risk Assessment Work Plan*. July 2010.
- ARCADIS BBL. 2007a. *Multi-Area Field Sampling Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Multi-Area FSP)*. April 2007.
- ARCADIS BBL. 2007b. *Multi-Area Health and Safety Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Multi-Area HSP)*. May 2007.
- ARCADIS BBL. 2007c. *Former Plainwell Impoundment Time-Critical Removal Action Design Report*. February 2007.
- BBL. 2000a. *Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site. Remedial Investigation Report – Phase 1*. October 2000.

- BBL. 2000b. Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site. Supplement to the Kalamazoo River RI/FS – Phase 1. October 2000.
- BBL. 2002. Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site. Technical Memorandum 10 – Sediment Characterization and Geostatistical Pilot Study. February 2002.
- Buchanan, B.T., Menasha Corporation. 1986. Affidavit. February 5, 1986. Dalrymple, D., 1972. Bah Jove! Otsego is the Dandy Town. Pamphlet.
- CDM. 2002. *Kalamazoo River and Portage Creek Wetland Delineation Study*. Prepared on behalf of the MDEQ. January 2002.
- CDM. 2003a. *Final (Revised) Baseline Ecological Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*. Prepared on behalf of the MDEQ Remediation and Redevelopment Division. April 2003.
- CDM. 2003b. *Final (Revised) Baseline Human Health Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*. Prepared on behalf of the MDEQ Remediation and Redevelopment Division. May 2003.
- CDM. 2009. Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site Summary of Baseline PCB Concentrations in Surface Water and Fish Tissue; Evaluation of Pre- and Post-TCRA Data from the Bryant Mill Pond; and Site-Wide Trends in Fish Tissue PCB Concentrations. May 2009
- CH2M HILL. 2003a. Remedial Investigation/Feasibility Study. Allied Paper/Portage Creek/Kalamazoo River. April 2003.
- CH2M HILL. 2003b. Plainwell and Otsego City Impoundment Floodplain Soils Draft Feasibility Study Report. Allied Paper/Portage Creek/Kalamazoo River. July 2003.
- CRA. 2009. Phase II Remedial Investigation Work Plan – Former Plainwell, Inc Mill Property, Plainwell, Michigan. May 2009
- CRA. 2010. Final Design Report – 12th Street Landfill, Otsego Township, Michigan. January 2010.
- Hayes, J. 1982. Telephone messages re: Otsego City Dam, March 19, 1982.
- Hayes, J. MDNR. 1991. Notes to the file, June 6, 1991.

MDEQ. 2007. State of Michigan Department of Environment Public Notice. July 13, 2007.

MDNRE. 2010. *Geomorphic Feature Delineation and PCB Correlations in the Former Plainwell Impoundment*. Prepared by CDM for MDNRE, May 2010.

Pahl, J.C. 1988. . Letter from J.C. Pahl, Metropolitan Title Company, to J. Bantjes, MDNR, re: Menasha Dam, December 7, 1988.

Pahl, J.C. 1998. Letter from J.C. Pahl, Metropolitan Title Company, to J. Hayes, MDEQ, re: Menasha Dam, September 24, 1998.

Rachol, C.M., Fitzpatrick, F.A., and Rossi, T., 2005. *Historical and Simulated Changes in Channel Characteristics of the Kalamazoo River, Plainwell to Otsego, Michigan*: U.S. Geological Survey Scientific Investigations Report 2005-5044.

Rheume, S.J., Rachol, C.M., Hubbell, D.L., and Simard, A., 2002. *Sediment Characteristics and Configuration within Three Dam Impoundments on the Kalamazoo River, Michigan, 2000*: U.S. Geological Survey Water-Resources Investigations Report 02-4098.

Rheume, S.J., Hubbell, D.L., Rachol, C.M., Simard, A., and Fuller, L.M., 2004. *Sediment Characteristics and Configuration within the Otsego City Dam Impoundment on the Kalamazoo River, Michigan, 2001-02*: U.S. Geological Survey Water-Resources Investigations Report 03-4218.

SME. 2004. Soil and Materials Engineers, Inc. Summary Report for 2004 Otsego Dam Modifications. September 15, 2004.

SME. 2007. Soil and Materials Engineers, Inc. Emergency Action Plan for Otsego City Dam. December 28, 2007.

Syed, A.U., Bennett, J.P., Rachol, C.M., 2004. *A Pre-Dam Removal Assessment of Sediment Transport for Four Dams on the Kalamazoo River between Plainwell and Allegan, Michigan*: U.S. Geological Survey Scientific Investigations Report 2004-5178.

USEPA. 2001. Superfund Record of Decision: Allied Paper, Inc./Portage Creek/Kalamazoo River, OU4. September 2001.

USEPA. 2006. Data Quality Assessment: A Reviewers Guide. EPA/240/B-002. February 2006.

USEPA. 2009. Letter from James Saric Regarding Request for Data Usability Determination. July 9. 2009.

USGS. 1973. Otsego, Michigan Quadrangle – 7.5 Minute Series Topographic.

Wells, R., Langendoen, E.J., Simon, A., 2007. *Modeling Pre- and Post-Dam Removal Sediment Dynamics: The Kalamazoo River, Michigan*: Journal of the American Water Resources Association Volume 43, Number 3. June 2007.

Weston. 2002. Removal Assessment Report for Allied Paper – Kalamazoo River Site Otsego/Plainwell, Michigan. Prepared for USEPA, February 2002.

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Area 2/Otsego City Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Table 3-2 -- Statistical Data Summary for Total PCBs in Area 2

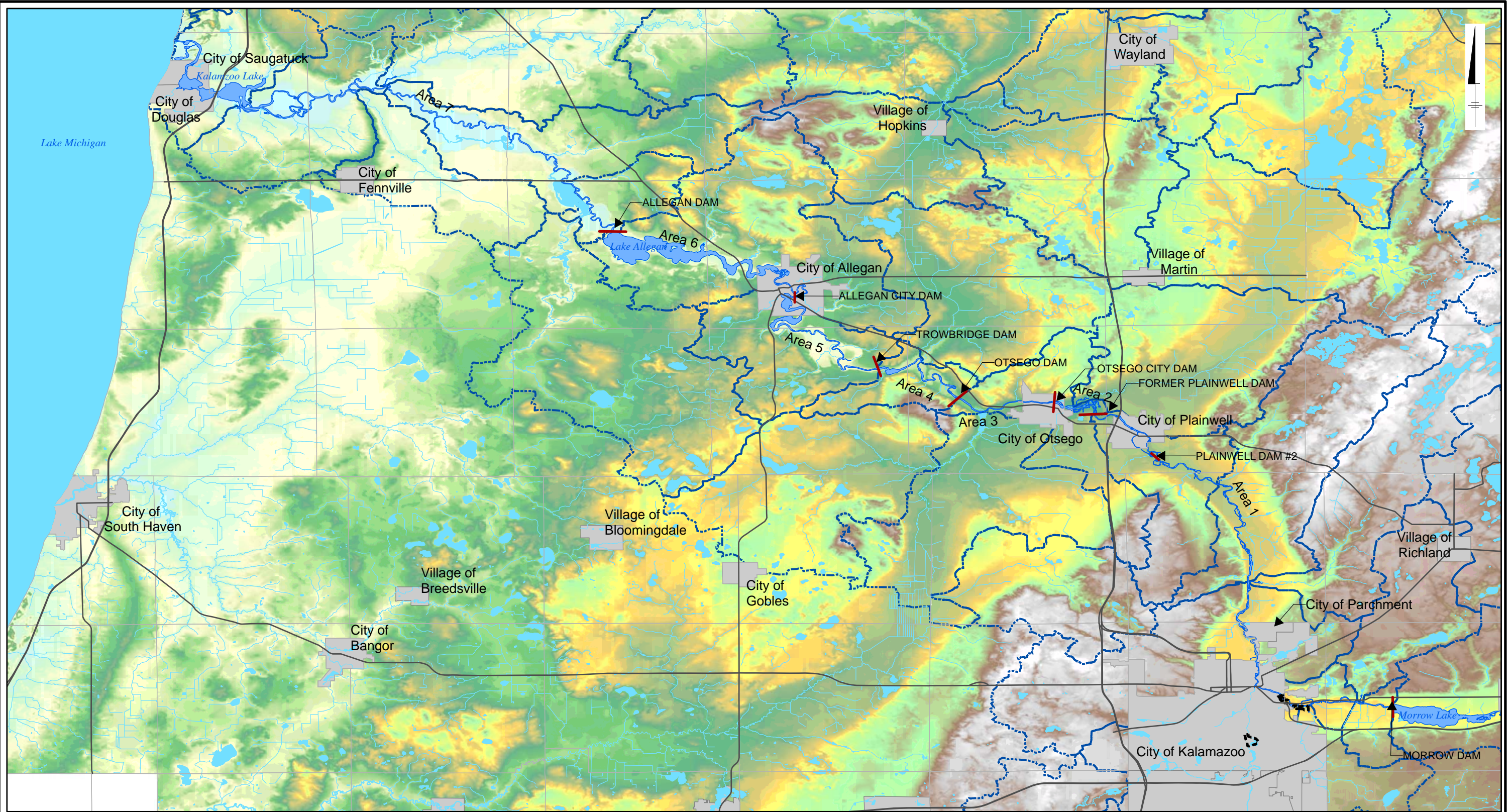
Dataset	Frequency of Detection	Range	Location of Max Detect	Arithmetic Mean ¹ (mg/kg)	Standard Deviation ¹ (mg/kg)	Geometric Mean ¹ (mg/kg)	Median ¹ (mg/kg)	Total Number of Samples Greater than				
								0.5 mg/kg	1.0 mg/kg	5.0 mg/kg	10 mg/kg	50 mg/kg
Sediment												
All Data	412/700 (58.9%)	ND(0.0090) - 94	KPT77-3 (0-2 inches)	1.8	8.2	0.12	0.065	137 (19.6%)	90 (12.9%)	44 (6.3%)	29 (4.1%)	7 (1.0%)
Fine ²	78/144 (54.2%)	ND(0.051) - 94	KPT77-3 (0-2 inches)	3.2	12	0.21	0.094	43 (29.9%)	30 (20.8%)	12 (8.3%)	9 (6.3%)	3 (2.1%)
Coarse ²	81/104 (77.9%)	ND(0.054) - 51	KP10C-6 (6-12 inches)	2.0	7.2	0.16	0.095	19 (18.3%)	12 (11.5%)	7 (6.7%)	6 (5.8%)	1 (1.0%)
Surface	160/199 (80.4%)	ND(0.0090) - 94	KPT77-3 (0-2 inches)	1.9	9.5	0.14	0.085	40 (20.1%)	24 (12.1%)	10 (5.0%)	6 (3.0%)	3 (1.5%)
Fine ²	33/43 (76.7%)	ND(0.055) - 94	KPT77-3 (0-2 inches)	4.6	17	0.45	0.42	20 (46.5%)	13 (30.2%)	4 (9.3%)	2 (4.7%)	2 (4.7%)
Coarse ²	33/38 (86.8%)	ND(0.057) - 14	KP10C-5 (0-2 inches)	0.51	2.3	0.10	0.086	3 (7.9%)	1 (2.6%)	1 (2.6%)	1 (2.6%)	0 (0.0%)
Subsurface	252/501 (50.3%)	ND(0.010) - 85	KP12F-1 (2-6 inches)	1.8	7.6	0.12	0.055	97 (19.4%)	66 (13.2%)	34 (6.8%)	23 (4.6%)	4 (0.8%)
Fine ²	45/101 (44.6%)	ND(0.051) - 85	KP12F-1 (2-6 inches)	2.6	10	0.16	0.065	23 (22.8%)	17 (16.8%)	8 (7.9%)	7 (6.9%)	1 (1.0%)
Coarse ²	48/66 (72.7%)	ND(0.054) - 51	KP10C-6 (6-12 inches)	2.8	8.8	0.21	0.13	16 (24.2%)	11 (16.7%)	6 (9.1%)	5 (7.6%)	1 (1.5%)
Floodplain Soil												
All Data ³	224/478 (46.9%)	ND(0.031) - 40	SD030-36 (12-18 inches)	1.1	4.3	0.11	0.090	82 (17.2%)	61 (12.8%)	28 (5.9%)	12 (2.5%)	0 (0.0%)
Surface ³	48/96 (50.0%)	ND(0.037) - 25	SL071 (0-6 inches)	1.6	3.5	0.15	0.037	30 (31.3%)	29 (30.2%)	12 (12.5%)	1 (1.0%)	0 (0.0%)
Subsurface ³	176/382 (46.1%)	ND(0.031) - 40	SD030-36 (12-18 inches)	1.0	4.4	0.10	0.090	52 (13.6%)	32 (8.4%)	16 (4.2%)	11 (2.9%)	0 (0.0%)

Notes:

1. One-half the detection limit was used as a proxy concentration for non-detects.
2. Fine/coarse statistics exclude samples collected during the EPA 2001 Phase I and II Investigation.
3. Excludes EPA Phase I samples collected at SL055, which falls within the boundary of the cleanup area at OU4.
4. ND = Not detected
5. mg/kg = milligrams per kilogram

Figures

\\SVP-05\MTK1\SYM0\JRAPP
KRS\G (64529.1.500)
q:\wsp\plainwell\dam\otsego\city\dam\sr\wp\mxd\site map - entire study area.mxd - 12/17/2010 @ 10:34:23 AM



LEGEND:

- DAM LOCATION (AND SRI/FS AREA BOUNDARY)
- ROAD
- TOWNSHIP BOUNDARY
- INCORPORATED AREA
- WATERSHED BOUNDARY

TOPOGRAPHY
ELEVATION (ft):

High : 1124.9
Low : 576.724

NOTE:

1. IMAGERY DOWNLOADED FROM THE MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION.



GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

KALAMAZOO RIVER SUPERFUND SITE


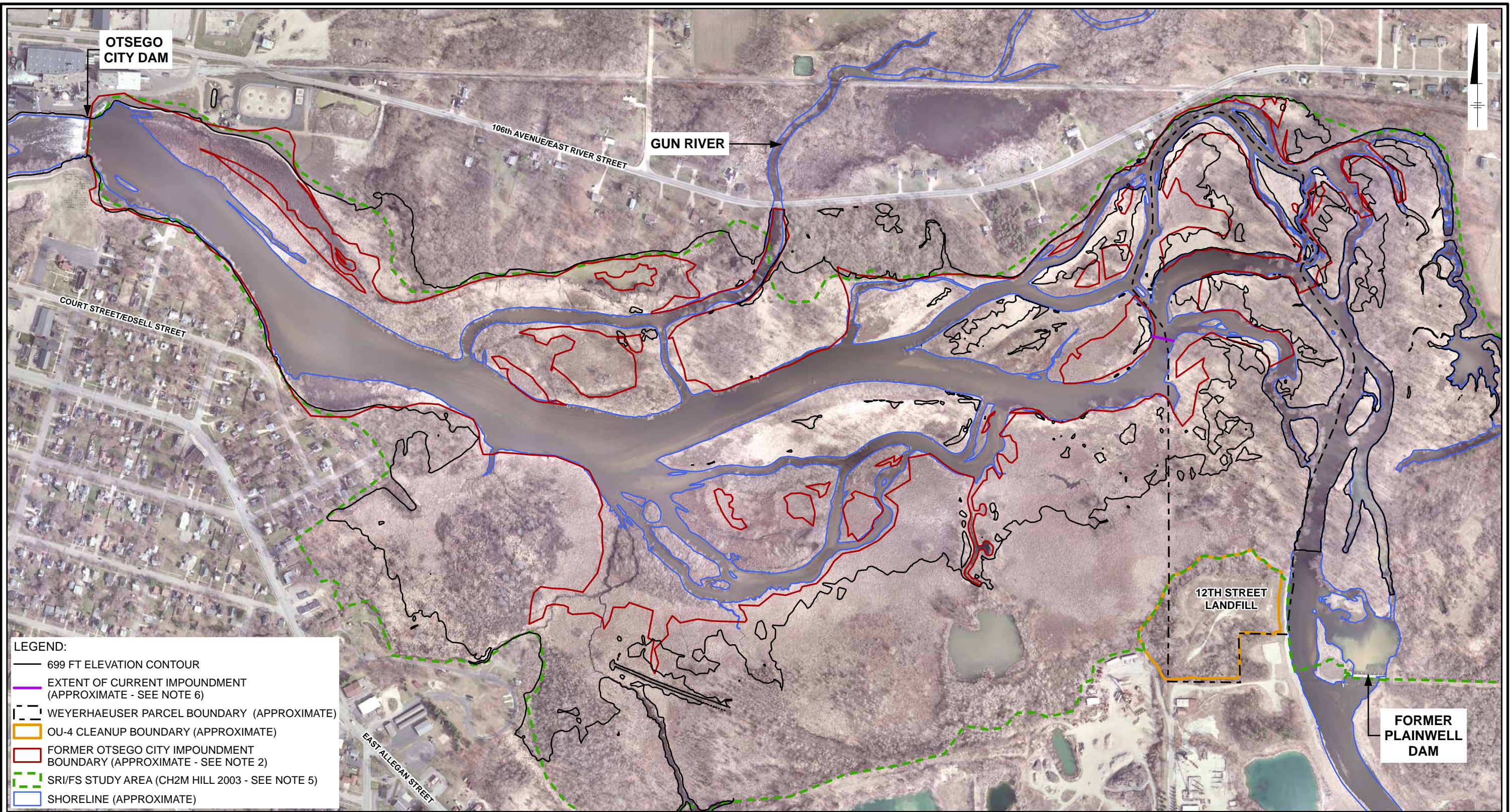


FIGURE
1-1

SYR-90 MTK ASH
KRS-90 (B0064629.0001.00500)
q:\msg\main\dam\otsegocitydam\sr\wp\mxd\site map - area 2.mxd - 12/17/2010 @ 10:32:14 AM



- LEGEND:
- 699 FT ELEVATION CONTOUR
 - EXTENT OF CURRENT IMPOUNDMENT (APPROXIMATE - SEE NOTE 6)
 - WEYERHAEUSER PARCEL BOUNDARY (APPROXIMATE)
 - OU-4 CLEANUP BOUNDARY (APPROXIMATE)
 - FORMER OTSEGO CITY IMPOUNDMENT BOUNDARY (APPROXIMATE - SEE NOTE 2)
 - SRI/FS STUDY AREA (CH2M HILL 2003 - SEE NOTE 5)
 - SHORELINE (APPROXIMATE)

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO CITY AREA FLOWN APRIL 2010.
2. FORMER OTSEGO CITY IMPOUNDMENT BOUNDARY BY ARCADIS BASED ON AN EVALUATION OF HISTORICAL AERIAL PHOTOGRAPHS SHOWING IMPOUNDED AREA FROM 1950 TO 1991 AND 1991 TO 1999.
3. OU-4 BOUNDARY FROM DRAWING C-02 OF THE 12TH STREET LANDFILL FINAL DESIGN REPORT, CRA, JANUARY 2010.
4. 699 FT TOPOGRAPHY CONTOUR CREATED FROM DIGITAL TERRAIN MODEL GENERATED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC.
5. CH2M HILL STUDY AREA BOUNDARY TAKEN FROM THE USEPA INTERNAL DRAFT REMEDIAL INVESTIGATION REPORT (CH2MHILL 2003) REVISED IN THE AREA OF 12TH STREET LANDFILL.
6. EXTENT OF CURRENT IMPOUNDMENT WAS REPORTED TO BE LOCATED AT USGS TRANSECT G10 IN WATER RESOURCES INVESTIGATIONS REPORT 03-4218 (USGS 2004).
7. PARCEL OWNERSHIP SHOWN IS BASED ON CURRENTLY AVAILABLE RECORDS. RESEARCH IS ONGOING REGARDING OWNERSHIP OF THE ISLANDS IN THE BRAIDED PORTIONS OF THE RIVER AND OTHER PARCELS; FUTURE VERSIONS OF THIS MAP WILL BE UPDATED AS WARRANTED.

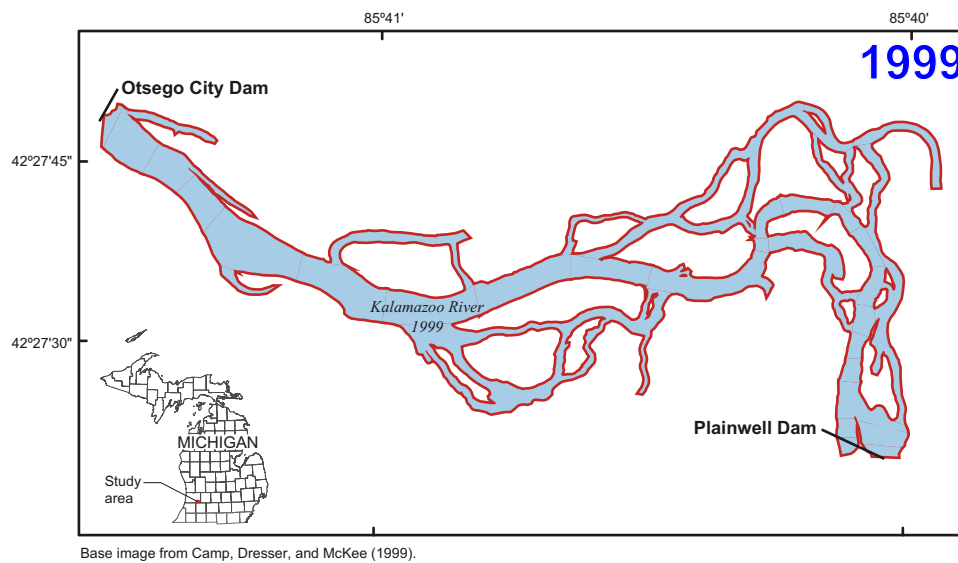
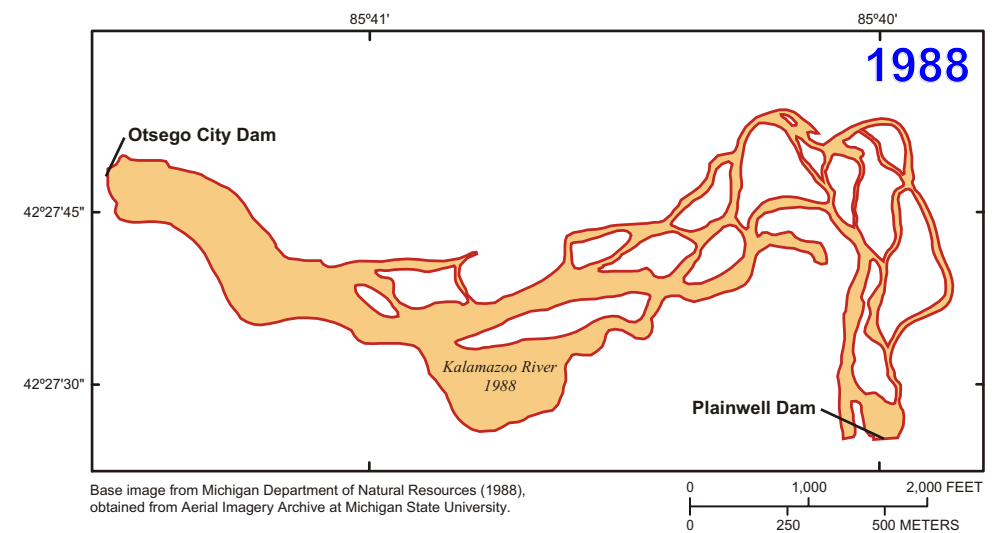
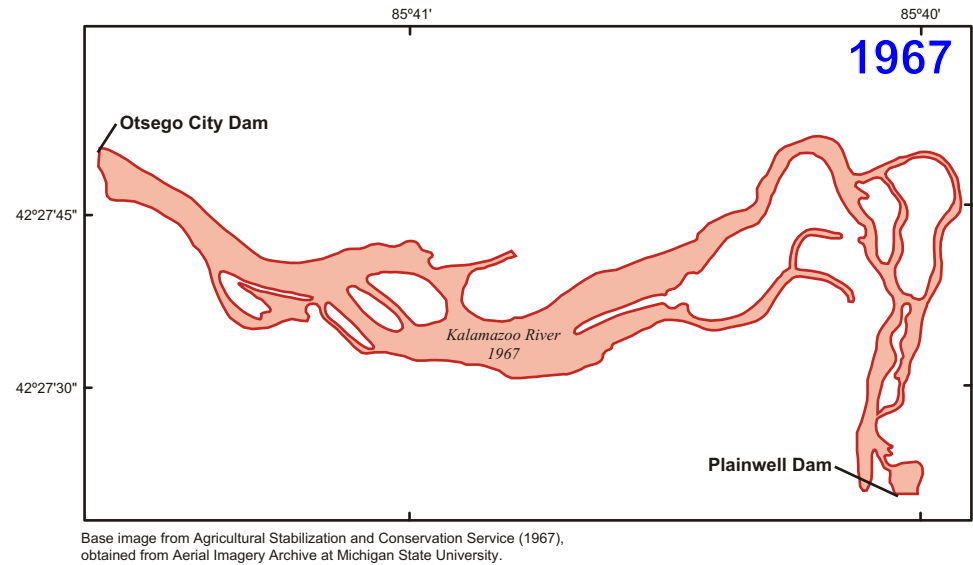
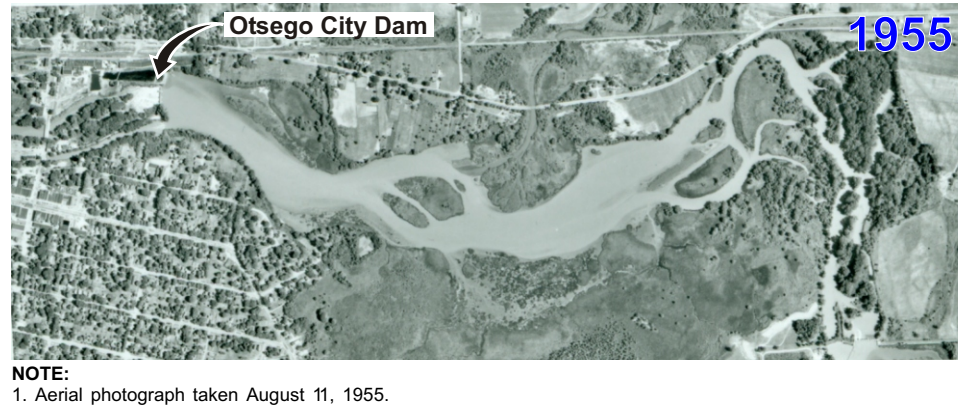
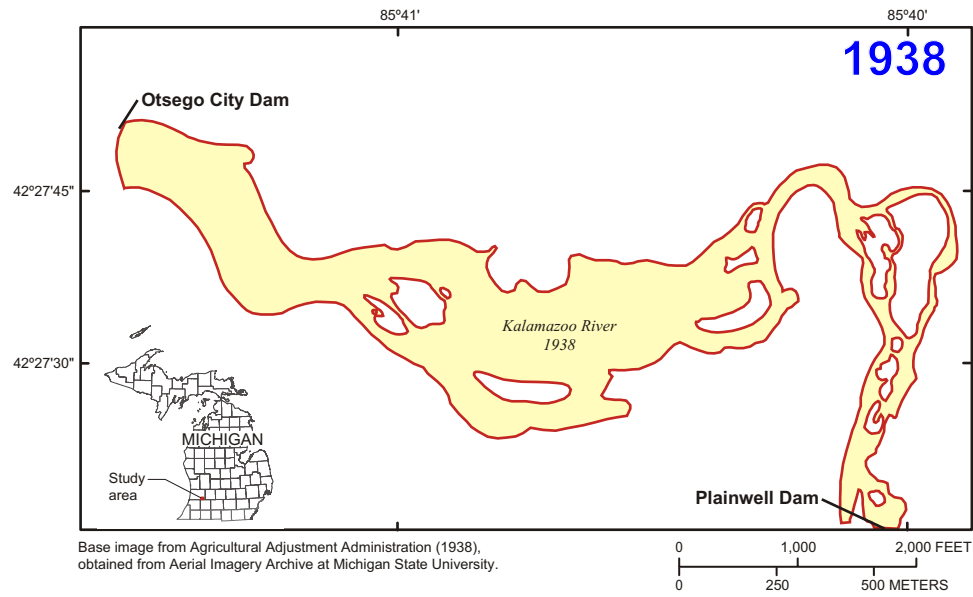


GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 2 SITE MAP



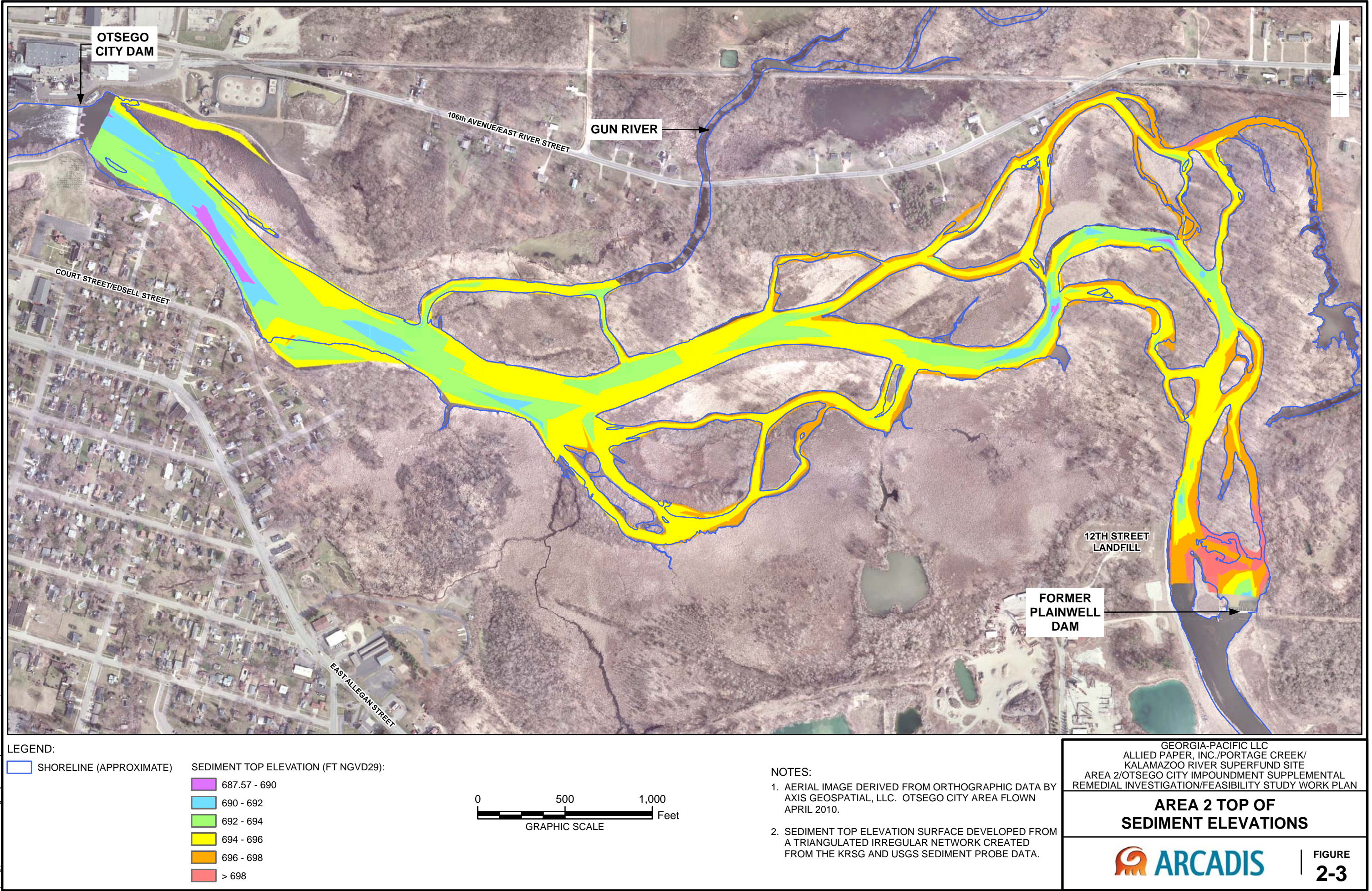
FIGURE
2-1

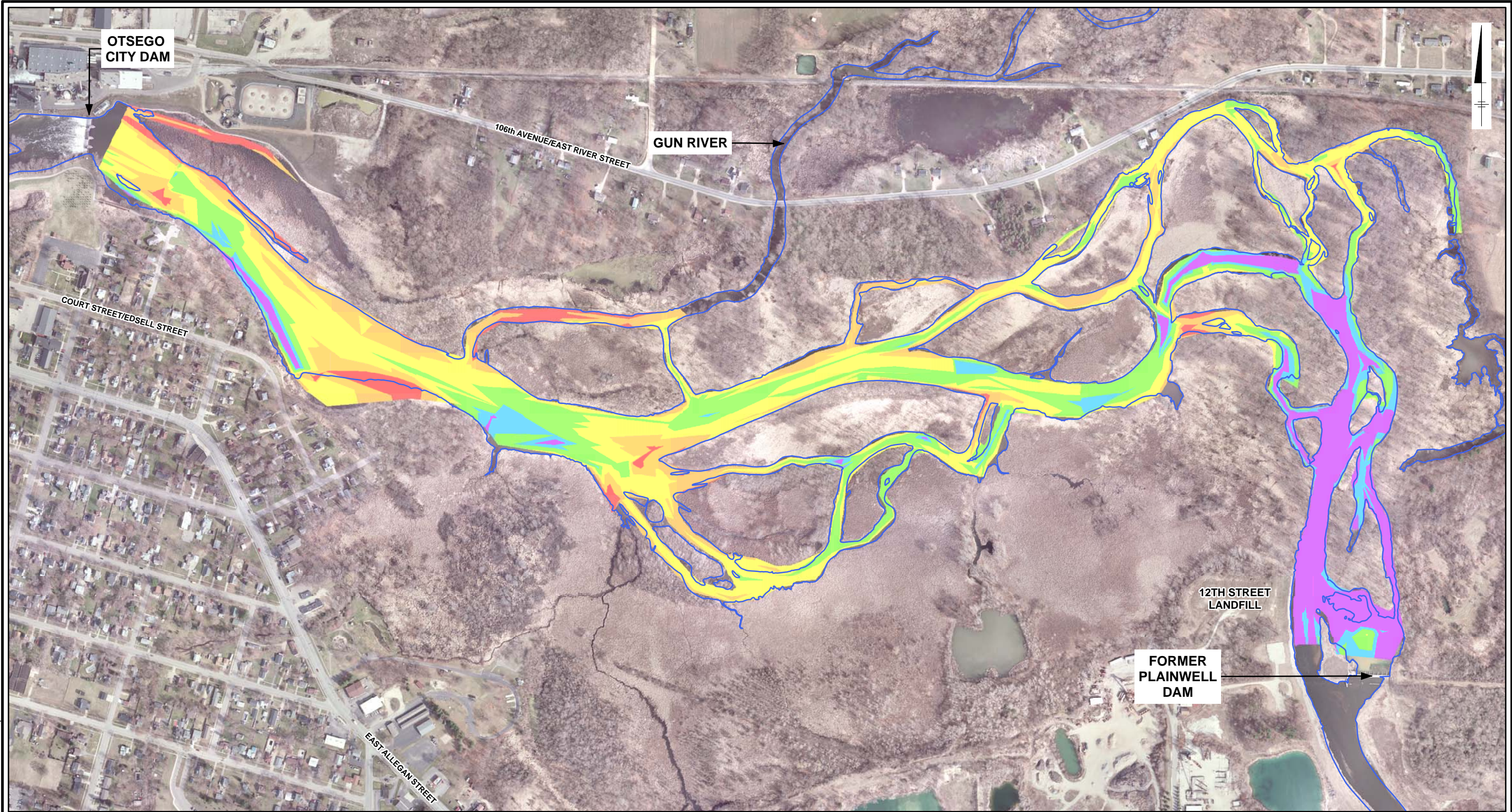


Notes:

1. Aerial photographs from 1958, 1967, 1988 and 1999 from USGS Water-Resources Investigations Report 03-4218.
2. Aerial photographs from 1955, 1960, 1974, and 1991 obtained from USGS.

SYR-90 MTK
KRS-G (B0064629.0001.00500)
q:\wsg\plainwell\dams\otsego\citydam\srwip\mxd\sediment top elevations from probe data.mxd - 12/17/2010 @ 10:29:52 AM





LEGEND:

SHORELINE (APPROXIMATE)	SEDIMENT THICKNESS (FT):
	0 - 1
	1 - 2
	2 - 4
	4 - 6
	6 - 8
	> 8



NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO CITY AREA FLOWN APRIL 2010.
2. SEDIMENT THICKNESS SURFACE DEVELOPED FROM A TRIANGULATED IRREGULAR NETWORK CREATED FROM THE KRSG AND USGS SEDIMENT PROBE DATA.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 2 SEDIMENT THICKNESS

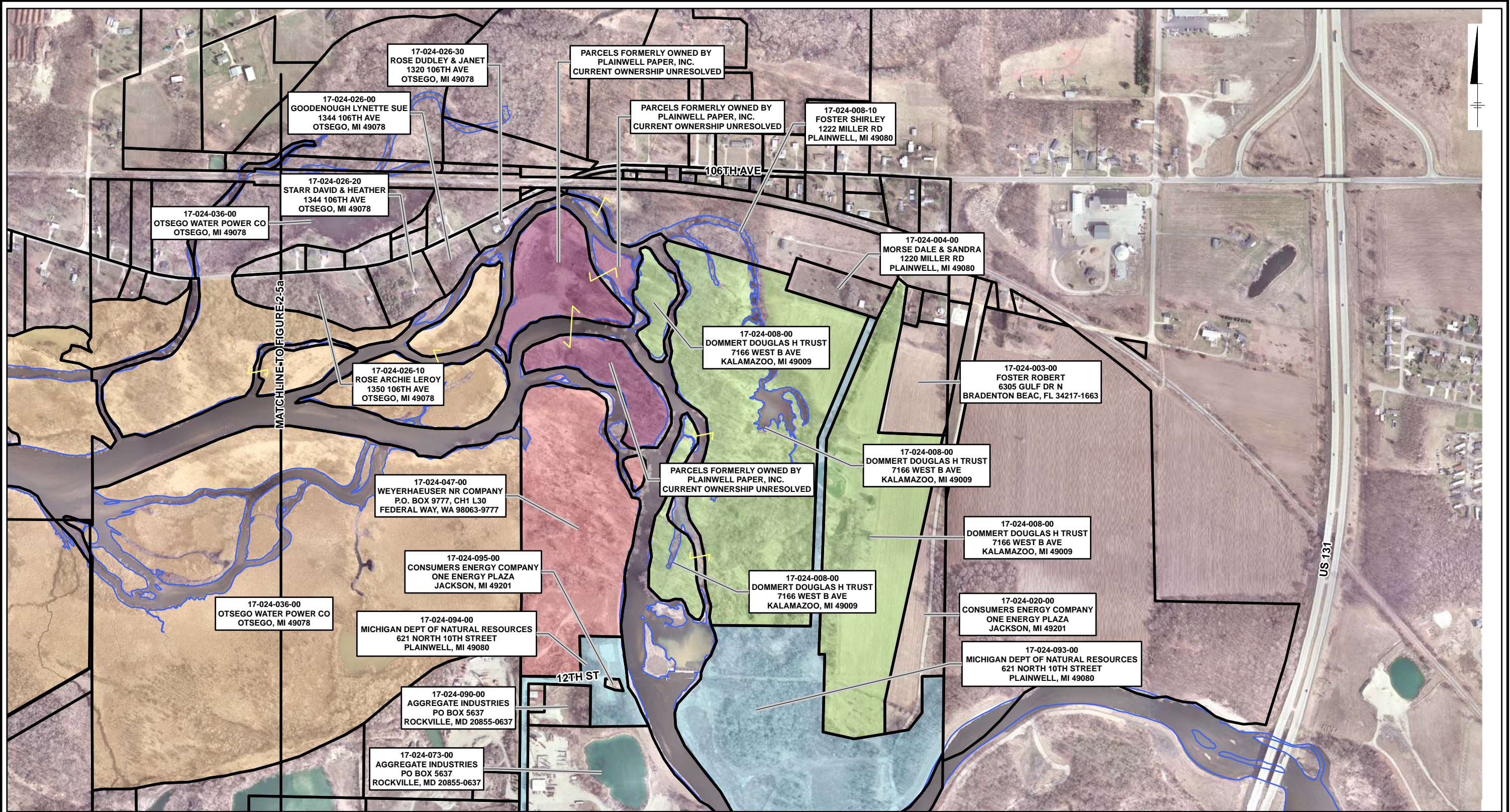


FIGURE
2-4



FIGURE
2-5a

CITY: SYR DIV/GROUP: IT DB: KES LD: PIC: PM: TM: TR:
KRSR (80064629.0001.00500)
C:\KRSR\PlainwellDam\OssegoCityDam\SR\WP\mxd\Parcels_OssegoCity_Figure2.mxd - 12/20/2010 @ 11:24:04 AM



LEGEND:

- | | |
|---------------------------------|--|
| PARCEL BOUNDARY | APPROXIMATE AREA OWNED BY WEYERHAEUSER NR COMPANY |
| SHORELINE (APPROXIMATE) | APPROXIMATE AREA OWNED BY THE CITY OF OTSEGO |
| APPROXIMATE AREA OWNED BY MDNRE | APPROXIMATE AREA OWNED BY THE DOUGLAS TRUST |
| | PARCELS FORMERLY OWNED BY PLAINWELL PAPER, INC. (CURRENT OWNERSHIP UNRESOLVED) |

17-024-008-00 DOMMERT DOUGLAS H TRUST 7166 WEST B AVE KALAMAZOO, MI 49009	TAX PARCEL ID OWNER NAME (LAST NAME, FIRST NAME) OWNER STREET ADDRESS OWNER CITY, STATE & ZIP CODE
--	---



NOTES:

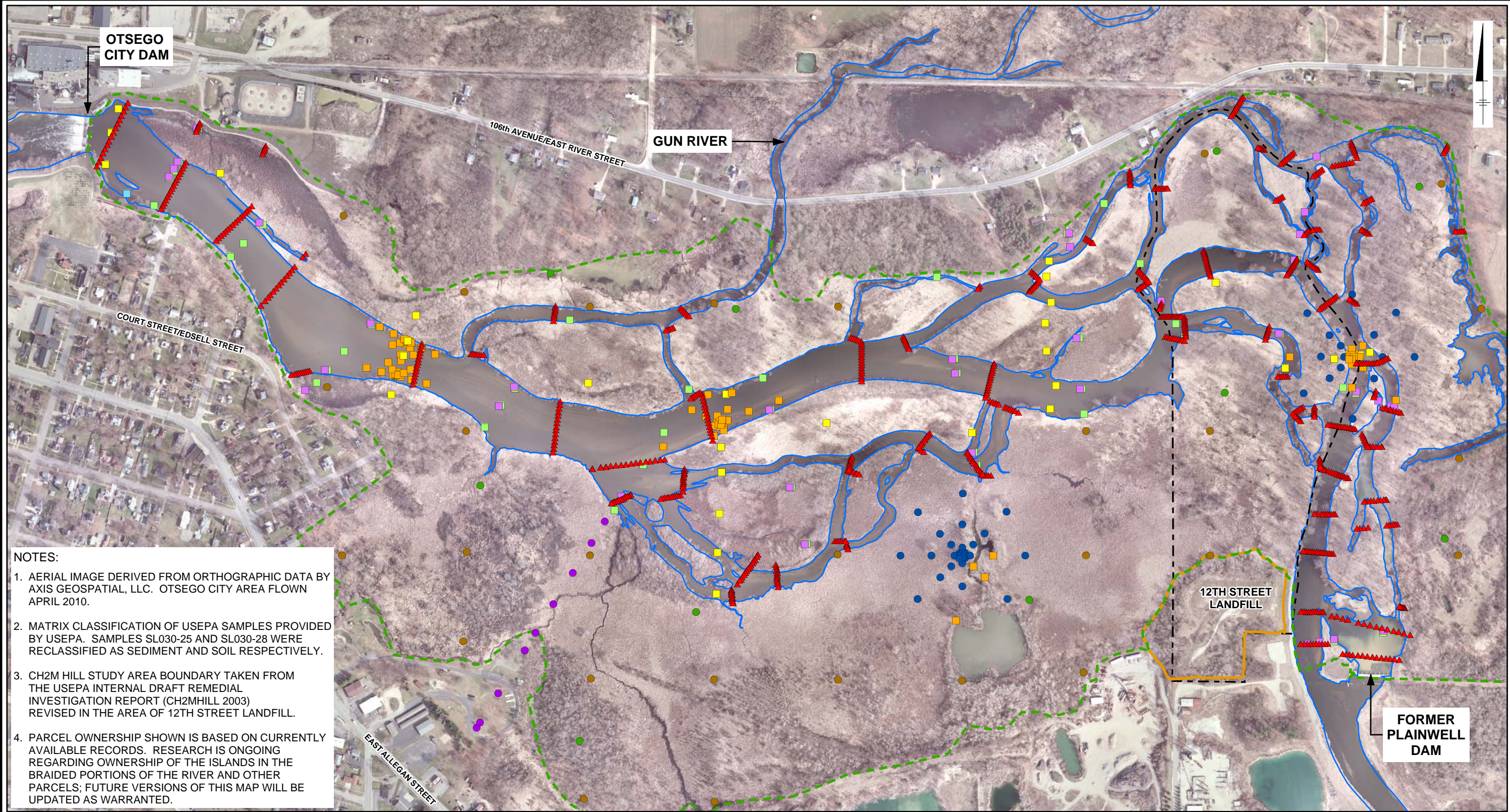
1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL. OTSEGO CITY AREA FLOWN APRIL 2010.
2. PARCEL BOUNDARIES WERE PROVIDED BY ALLEGAN COUNTY.
3. PARCEL OWNERSHIP SHOWN IS BASED ON CURRENTLY AVAILABLE RECORDS. RESEARCH IS ONGOING REGARDING OWNERSHIP OF THE ISLANDS IN THE BRAIDED PORTIONS OF THE RIVER AND OTHER PARCELS; FUTURE VERSIONS OF THIS MAP WILL BE UPDATED AS WARRANTED.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

**TAX PARCELS RELATED
TO AREA 2**

ARCADIS

FIGURE
2-5b



- NOTES:
1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO CITY AREA FLOWN APRIL 2010.
 2. MATRIX CLASSIFICATION OF USEPA SAMPLES PROVIDED BY USEPA. SAMPLES SL030-25 AND SL030-28 WERE RECLASSIFIED AS SEDIMENT AND SOIL RESPECTIVELY.
 3. CH2M HILL STUDY AREA BOUNDARY TAKEN FROM THE USEPA INTERNAL DRAFT REMEDIAL INVESTIGATION REPORT (CH2MHILL 2003) REVISED IN THE AREA OF 12TH STREET LANDFILL.
 4. PARCEL OWNERSHIP SHOWN IS BASED ON CURRENTLY AVAILABLE RECORDS. RESEARCH IS ONGOING REGARDING OWNERSHIP OF THE ISLANDS IN THE BRAIDED PORTIONS OF THE RIVER AND OTHER PARCELS; FUTURE VERSIONS OF THIS MAP WILL BE UPDATED AS WARRANTED.

LEGEND:

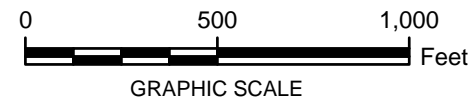
SEDIMENT SAMPLE LOCATION
SAMPLING EVENT:

- 1993/1994 SEDIMENT INVESTIGATION (KRSG)
- 2000 GEOCHRONOLOGICAL INVESTIGATION (KRSG)
- 2000 MORROW DAM TO LAKE ALLEGAN DAM SEDIMENT SAMPLING (KRSG)
- 2001 EPA PHASE I SAMPLING (USEPA)
- 2001 EPA PHASE II SAMPLING (USEPA)

SOIL SAMPLE LOCATION
SAMPLING EVENT:

- 1993 FLOODPLAIN INVESTIGATION (KRSG)
- 2000 FOCUSED FLOODPLAIN SAMPLING (KRSG)
- 2001 EPA PHASE I SAMPLING (USEPA)
- 2001 EPA PHASE II SAMPLING (USEPA)
- 2001-2002 CHANNEL SURVEY AND SEDIMENT CHARACTERIZATION (USGS)

- WEYERHAEUSER PARCEL BOUNDARY (APPROXIMATE)
- OU-4 CLEANUP BOUNDARY (APPROXIMATE)
- SHORELINE (APPROXIMATE)
- SRI/FS STUDY AREA (CH2M HILL 2003 - SEE NOTE 3)

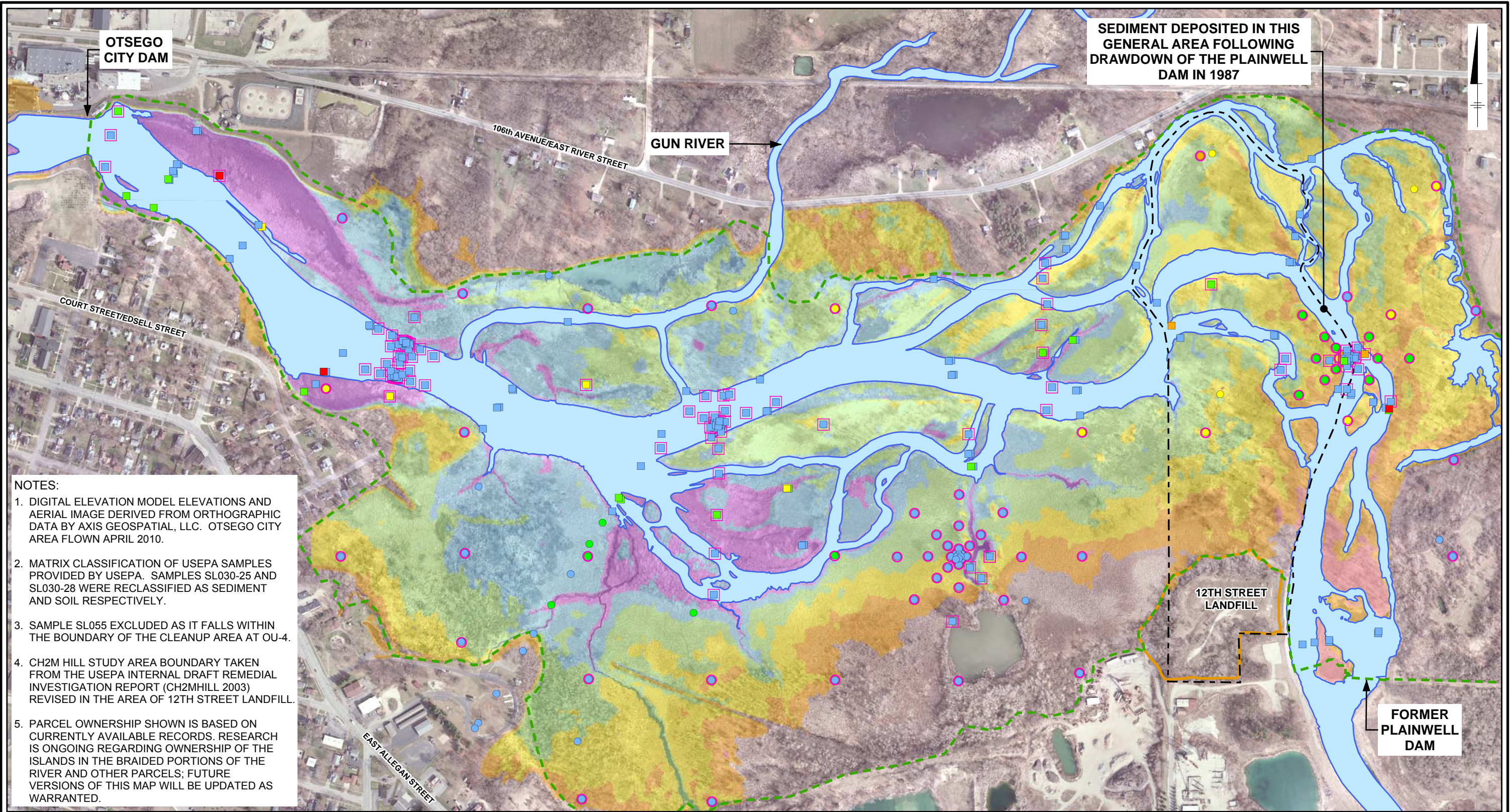


GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 2 DATA
COLLECTED TO DATE



FIGURE
3-1



- NOTES:
1. DIGITAL ELEVATION MODEL ELEVATIONS AND AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO CITY AREA FLOWN APRIL 2010.
 2. MATRIX CLASSIFICATION OF USEPA SAMPLES PROVIDED BY USEPA. SAMPLES SL030-25 AND SL030-28 WERE RECLASSIFIED AS SEDIMENT AND SOIL RESPECTIVELY.
 3. SAMPLE SL055 EXCLUDED AS IT FALLS WITHIN THE BOUNDARY OF THE CLEANUP AREA AT OU-4.
 4. CH2M HILL STUDY AREA BOUNDARY TAKEN FROM THE USEPA INTERNAL DRAFT REMEDIAL INVESTIGATION REPORT (CH2MHILL 2003) REVISED IN THE AREA OF 12TH STREET LANDFILL.
 5. PARCEL OWNERSHIP SHOWN IS BASED ON CURRENTLY AVAILABLE RECORDS. RESEARCH IS ONGOING REGARDING OWNERSHIP OF THE ISLANDS IN THE BRAIDED PORTIONS OF THE RIVER AND OTHER PARCELS; FUTURE VERSIONS OF THIS MAP WILL BE UPDATED AS WARRANTED.

LEGEND:

SURFACE SOIL PCB RESULTS (MG/KG):

- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- EPA SOIL SAMPLE LOCATION

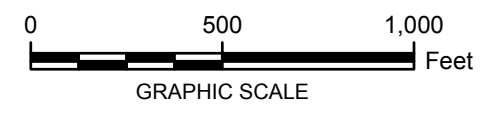
SURFACE SEDIMENT PCB RESULTS (MG/KG):

- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- EPA SEDIMENT SAMPLE LOCATION

UPLAND DIGITAL ELEVATION MODEL ELEVATIONS (FT NGVD29):

- ≤ 697
- 697 - 698
- 698 - 699
- 699 - 700
- 700 - 701
- > 701

- WEYERHAEUSER PARCEL BOUNDARY (APPROXIMATE)
- OU-4 CLEANUP BOUNDARY (APPROXIMATE)
- RIVER (APPROXIMATE)
- SRI/FS STUDY AREA (CH2M HILL 2003 - SEE NOTE 4)



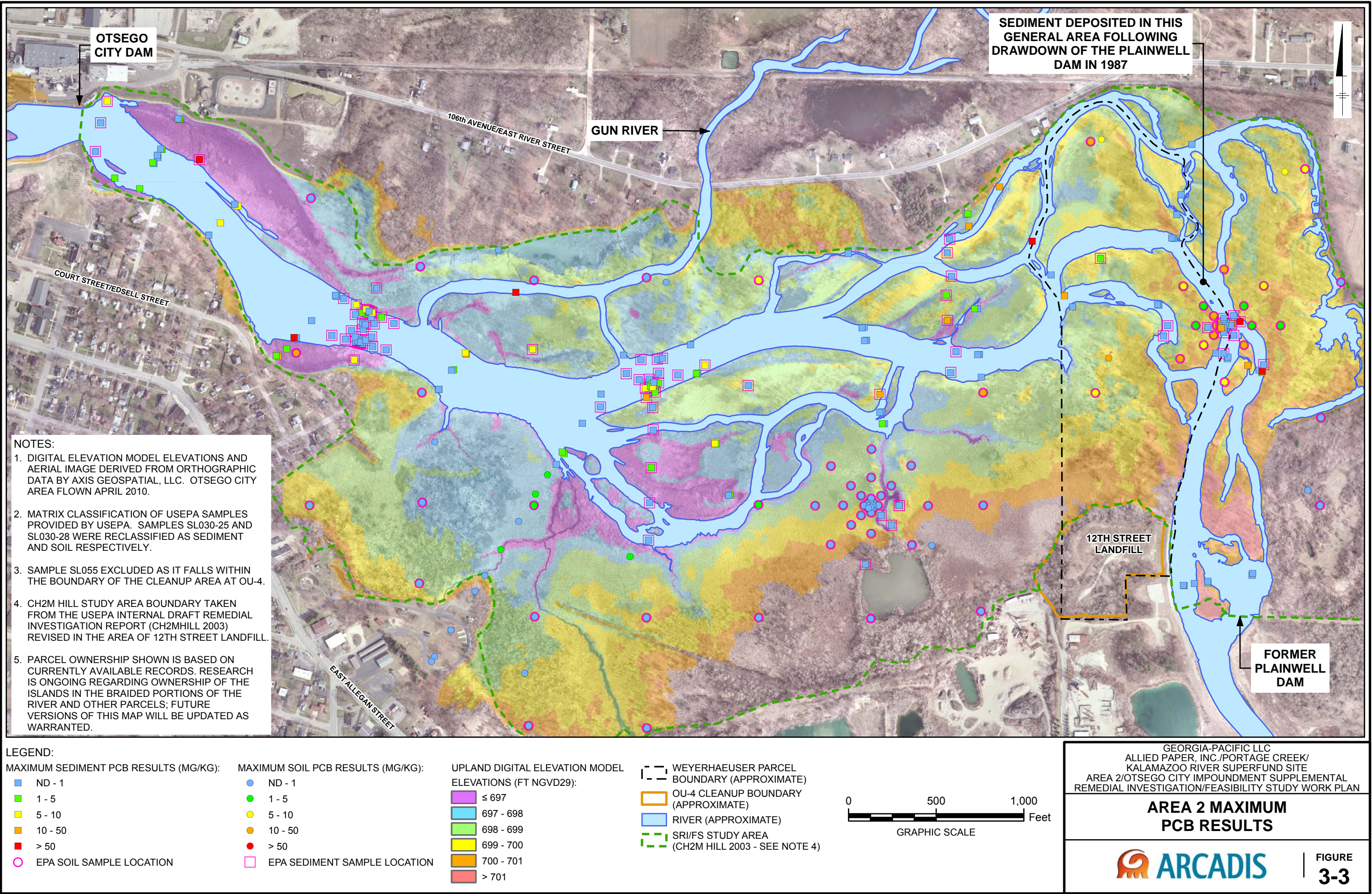
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

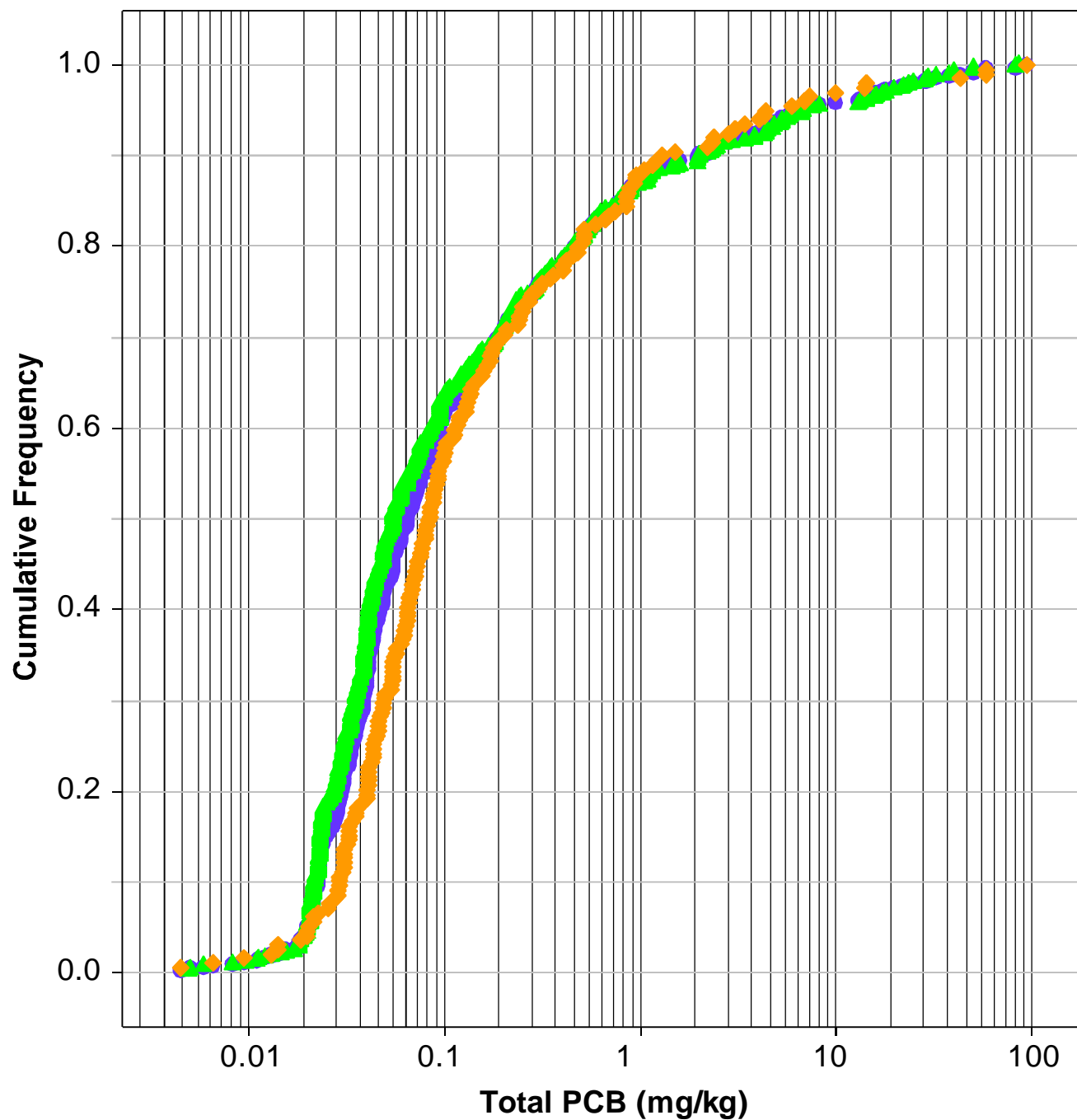
AREA 2 SURFACE
PCB RESULTS

FIGURE
3-2

SYR-90 MTK KES MTK
KRS-90 (B0064629.0001.00500)
q:\msd\plainwell\dam\otsego\city\surface\pcbs including upland dtm.mxd - 12/17/2010 @ 10:36:31 AM

SYR90 MTK ASH KES
KRSR (B0064E29.0001.00500)
q:\ms\plainwell\dam\otsegocitydam\src\wp\mxd\maximum pcs including upland dtm.mxd - 12/17/2010 @ 10:06:12 AM





Legend:

- All Depths
- ▲ Subsurface
- ◆ Surface

Notes:

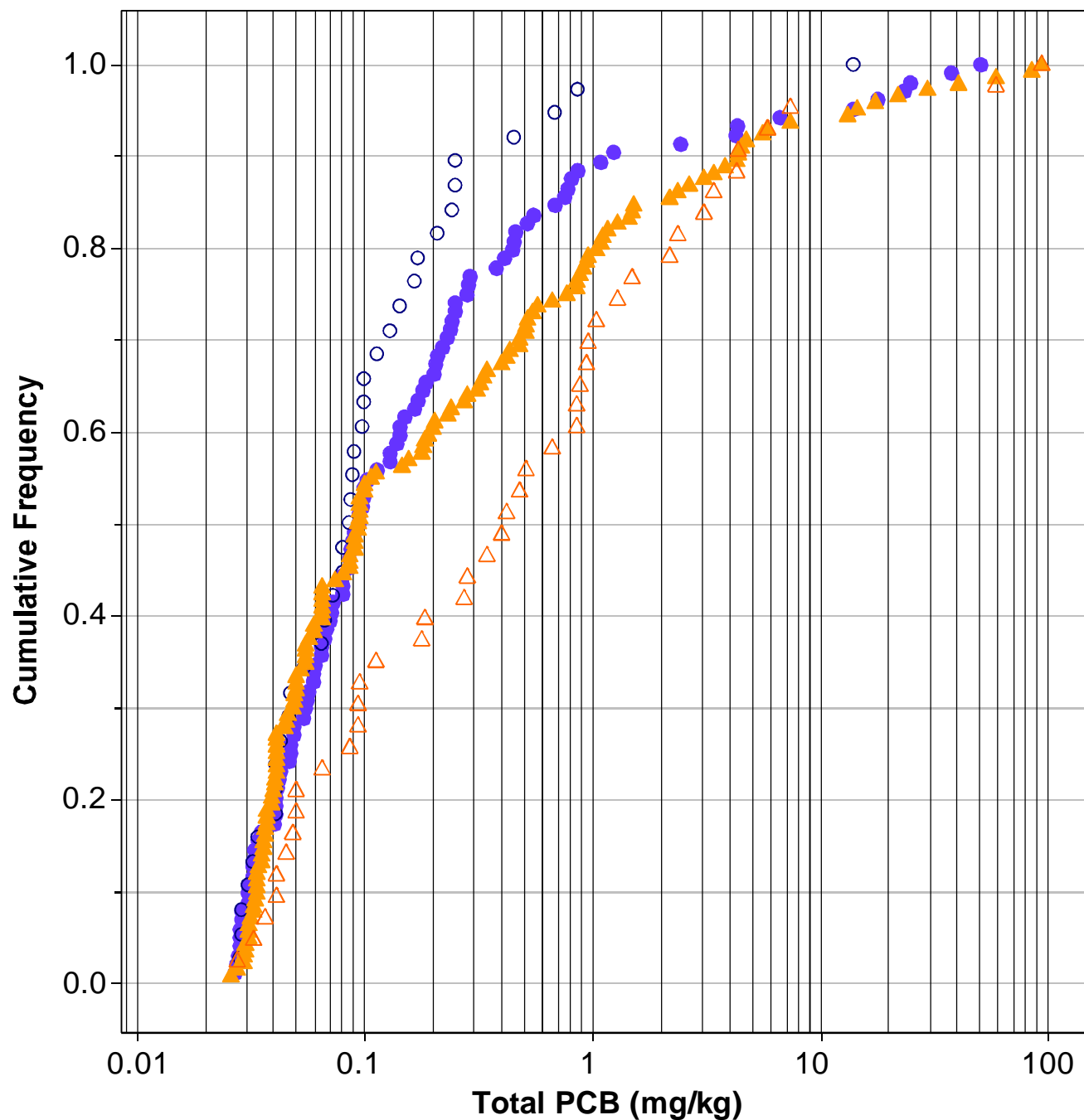
1. Data includes samples collected by KRSG in 1993, 1994, and 2000 and EPA in 2001.
2. Non-detects were counted as ½ the detection limit.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
**AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN**

**CUMULATIVE FREQUENCY
DISTRIBUTION OF AREA 2
SEDIMENT SAMPLES**



FIGURE
3-4



Legend:

- ▲ Fine (All Depths)
- △ Fine (Surface)
- Coarse (All Depths)
- Coarse (Surface)

Notes:

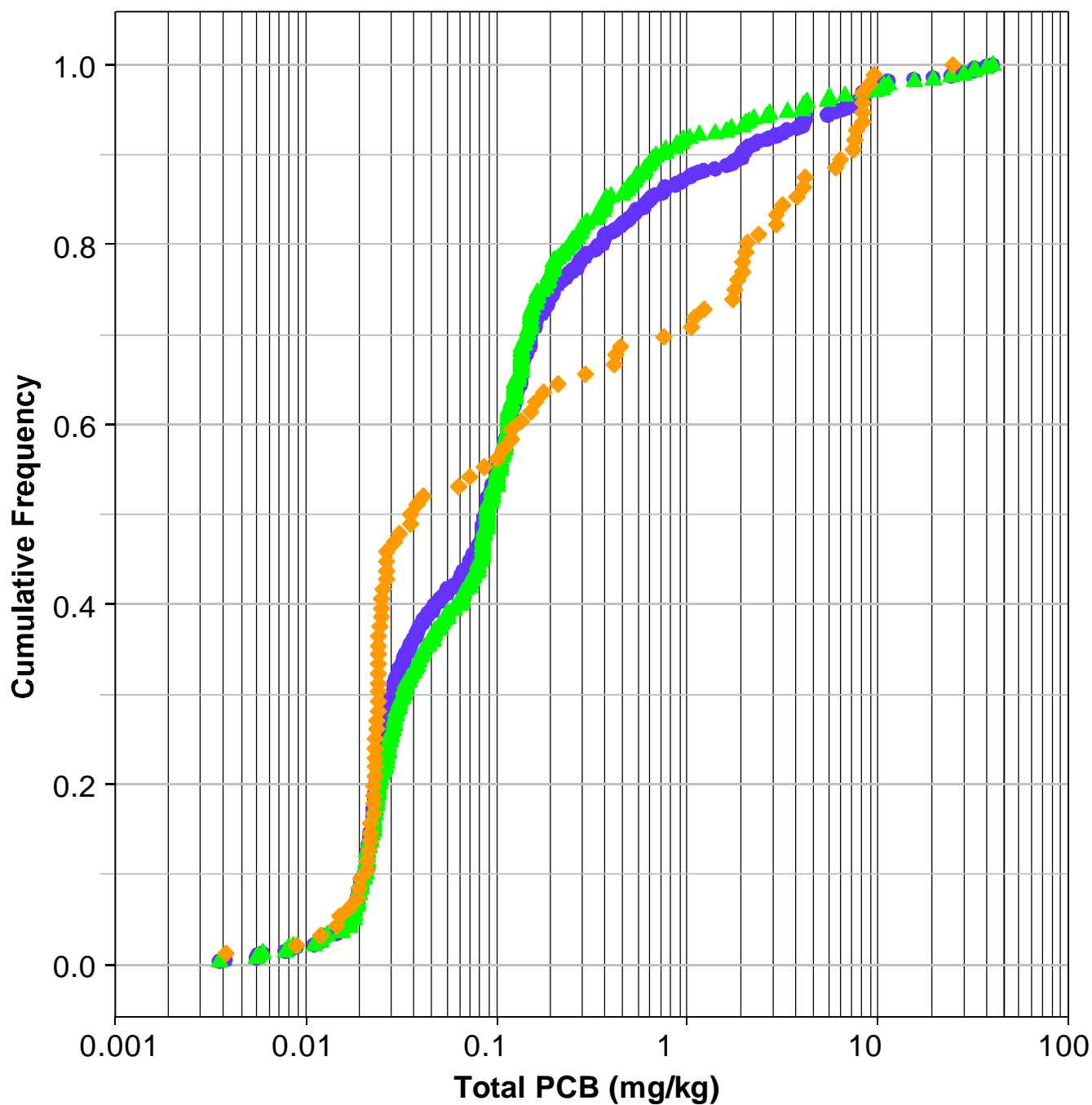
1. Data includes samples collected by KRSB in 1993, 1994, and 2000.
2. Non-detects were counted as ½ the detection limit.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
**AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN**

**CUMULATIVE FREQUENCY
DISTRIBUTION OF AREA 2
FINE AND COARSE SEDIMENT SAMPLES**



FIGURE
3-5



Legend:

- All Depths
- ▲ Subsurface
- ◆ Surface

Notes:

1. Data includes samples collected by KRSG in 1993, 1994, and 2000 and EPA in 2001.
2. Non-detects were counted as ½ the detection limit.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
**AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN**

**CUMULATIVE FREQUENCY
DISTRIBUTION OF AREA 2
SOIL SAMPLES**



FIGURE
3-6

SYR-90 MTK ASH
KRS-90 (B0064629.0001.00500)
q:\syrgo\mtd\otsegocitydam\syrgo\proposed sediment resample locations.mxd - 12/17/2010 @ 10:20:06 AM



LEGEND:

- PROPOSED SURFACE SEDIMENT RE-SAMPLE LOCATION
- WEYERHAEUSER PARCEL BOUNDARY (APPROXIMATE)
- OU-4 CLEANUP BOUNDARY (APPROXIMATE)
- SHORELINE (APPROXIMATE)
- SRI/FS STUDY AREA (CH2MHILL 2003 - SEE NOTE 4)

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO CITY AREA FLOWN APRIL 2010.
2. OU-4 BOUNDARY FROM DRAWING C-02 OF THE 12TH STREET LANDFILL FINAL DESIGN REPORT, CRA, JANUARY 2010.
3. SEDIMENT RESAMPLE LOCATIONS ARE AT LOCATIONS PREVIOUSLY SAMPLED IN BOTH 1993 AND 2000.
4. CH2M HILL STUDY AREA BOUNDARY TAKEN FROM THE USEPA INTERNAL DRAFT REMEDIAL INVESTIGATION REPORT (CH2MHILL 2003) REVISED IN THE AREA OF 12TH STREET LANDFILL.
5. PARCEL OWNERSHIP SHOWN IS BASED ON CURRENTLY AVAILABLE RECORDS. RESEARCH IS ONGOING REGARDING OWNERSHIP OF THE ISLANDS IN THE BRAIDED PORTIONS OF THE RIVER AND OTHER PARCELS; FUTURE VERSIONS OF THIS MAP WILL BE UPDATED AS WARRANTED.

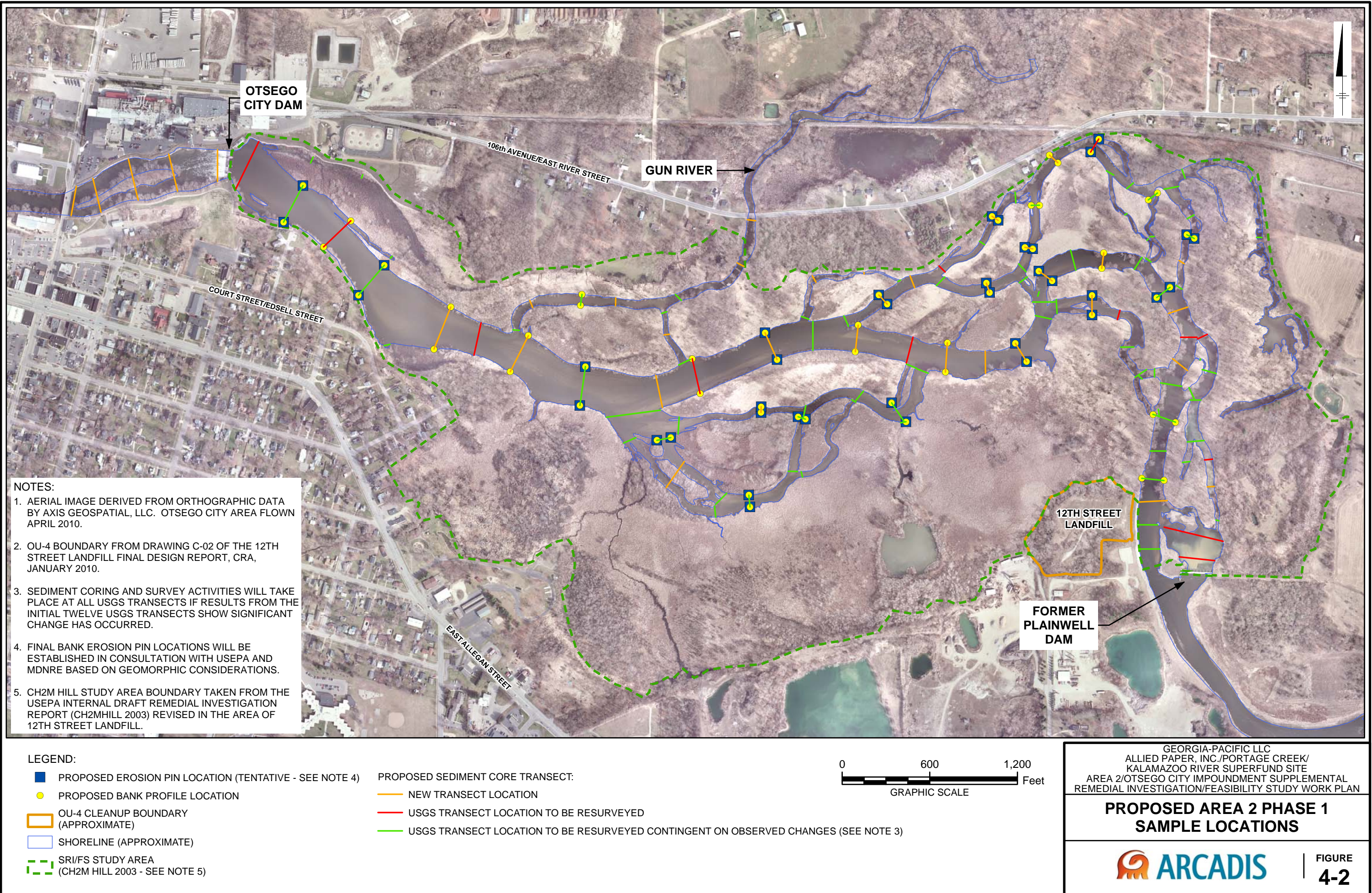
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 2/OTSEGO CITY IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

PROPOSED AREA 2 SURFACE SEDIMENT RE-SAMPLE LOCATIONS



FIGURE
4-1

SYR-90 MTK ASH KES
KRS-90 (B0064629.0001.00500)
q:\syrg\plainwell\dam\otsegocitydam\syrg\proposed sediment probe transects.mxd - 12/17/2010 @ 10:15:48 AM



Appendix A

Investigation-Derived Waste
Management Plan

**Allied Paper, Inc./Portage Creek/
Kalamazoo River Superfund Site**

**Supplemental Remedial Investigations/
Feasibility Studies**

**Area 2/Otsego City Impoundment
Supplemental Remedial
Investigation/Feasibility Study
Work Plan**

**Appendix A: Investigation Derived
Waste Management Plan**

Georgia-Pacific LLC

December 2010



A handwritten signature in black ink, reading "Michael J. Erickson".

Michael J. Erickson, P.E.
Project Coordinator

**Area 2/Otsego City
Impoundment Supplemental
Remedial Investigation/
Feasibility Study Work Plan**

**Appendix A: Investigation Derived
Waste Management Plan**

Prepared for:
Georgia-Pacific LLC

Prepared by:
ARCADIS
10559 Citation Drive
Suite 100
Brighton
Michigan 48116
Tel 810.229.8594
Fax 810.229.8837

Our Ref.:
B0064529.0001.00500

Date:
December 2010

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1. Introduction	1
2. IDW Collection and Temporary Storage	1
3. Waste Characterization	3
4. Transportation and Disposal	4
5. Recordkeeping	5
6. Reference	6

1. Introduction

A wide variety of investigation, sampling, and other field activities are carried out on a regular basis throughout the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site). During the course of this work on the river and at the individual operable units (OUs) of the Site, the Kalamazoo Field Office – operated and managed by ARCADIS on behalf of Georgia-Pacific LLC (Georgia-Pacific) – is often used as a sample processing station and storage facility. The investigation-derived waste (IDW) materials generated at the office typically include excess or unused soil, sediment, and biological sample material; decontamination water; and used personal protective equipment (PPE). IDW must be managed effectively and consistently to avoid or minimize long-term accumulation, and procedures must be established to ensure good housekeeping practices and proper disposal.

The key goals of effectively managing IDW and archived samples generated during Site activities are to:

- reduce potential for error in sample management
- provide clear procedures for good housekeeping
- verify documentation of proper disposal
- document archived samples and IDW status so responsibility can be transferred if necessary
- provide for regular, periodic review and disposal of unneeded archived samples

In this *Investigation Derived Waste Management Plan*, protocols for storing, labeling, characterizing, and disposing of IDW generated during Kalamazoo River field activities are described, along with requirements for recordkeeping. All staff who work in the field and use the field office are required to understand and abide by these procedures.

This plan is applicable to all areas and OUs of the Site.

2. IDW Collection and Temporary Storage

All unused sample materials and waste generated during the processing of environmental samples from Kalamazoo River field activities will be handled appropriately, as described below.

Unused Samples – Samples/cores that are collected but not initially analyzed may be archived in frozen storage pending determination of the need for analysis, if the relevant work plan specifically requires the samples to be archived. Frozen materials are classified as samples until the Georgia-Pacific and ARCADIS project managers determine that the samples are no longer needed, at which time they are considered waste. Records of all frozen/archived samples are to be maintained at the field office so that freezer capacity and inventory can be easily assessed prior to starting a new investigation or sampling event.

Waste Materials – Excess materials generated during environmental sample processing and other IDW (PPE, decontamination water) are to be placed in 55-gallon steel or polyethylene drums pending disposal. All drums are to be staged on a sturdy pallet, and placed in a designated area that can be readily accessed by removal equipment (e.g., drum handling truck, fork lift). Materials are to be segregated into drums dedicated for particular waste materials (PPE, decontamination water, or soil/sediment/biota), and each drum is to have a clearly visible label. Labels must include the following information:

- Contents (e.g., Lake Allegan Sediments, Soils/Sediments from the Plainwell No. 2 Dam Area, Decontamination Water, PPE from the Willow Boulevard/A-Site OU).
- First date of accumulation, and subsequent dates that IDW is added to the drum.
- Ongoing approximation of how full the container is (e.g., 50% full). The fill level may also be marked on the outside of the drum.
- When full, the label must also include the status of chemical characterization (e.g., not characterized, chemical characterization pending, chemically characterized as non-Toxic Substances Control Act [TSCA] material)

New labels may be affixed for each successive field effort in which IDW is placed in drums, resulting in a single drum having more than one label prior to arrangement for disposal. Once a drum is full, it will be properly characterized and disposed within 180 days. Drum disposal is to be managed on an ongoing basis, concurrent with disposal activities associated with work conducted in multiple areas of the Site.

Waste Soil/Sediment Handling – If excess soils or sediments are saturated, sufficient bentonite powder (or functional equivalent) will be placed at the bottom of a drum to

soak up the water. Bentonite will also be added as needed during additional placement of excess soils/sediments into the drum to soak up excess fluids.

Decontamination Water Handling – The 55-gallon drums used to store decontamination water must have adequate secondary containment. Each 55-gallon drum used for decontamination water must be placed inside a 65- or 85-gallon overpack drum that meets the minimum U.S. Department of Transportation (USDOT) requirements for salvage drums, per applicable federal regulations (i.e., 49 Code of Federal Regulations, Section 173.3(c)).

Frozen Archive Samples – Individual soil samples, sediment cores, or biota samples that are archived in frozen storage are to be labeled according to the requirements specified in the relevant Field Sampling Plan, Quality Assurance Project Plan, and chain-of-custody Standard Operating Procedure. A sample inventory form will be placed in a plastic sleeve and attached to the front of each freezer. Redundant copies of the inventory form will be forwarded to the ARCADIS-Syracuse, New York and ARCADIS-Chicago, Illinois offices at the end of a field activity in which collected samples are placed in storage. At a minimum, the sample ID number, sample type, date collected, and name of the person who collected the sample(s) (or placed them in storage) must be recorded on the form each time a sample is added to the freezer. Whenever possible, samples from a particular sampling event should be grouped together in the freezer. Labels should be facing toward the front of the freezer for ease of sample identification. Cores must be stored vertically with top end up, and caps must be affixed firmly onto the ends of the tubes with duct tape.

3. Waste Characterization

All IDW – with the exception of PPE – must be characterized to determine the proper method of disposal. Typically, polychlorinated biphenyl (PCB) concentrations in materials processed and stored at the Kalamazoo Field Office are low and could be disposed as non-TSCA/non-hazardous waste. However, there are some sediment/soil samples that may be designated as TSCA waste and would therefore need to be managed and disposed according to TSCA and other federal regulations relating to transportation (40 CFR 761 and 49 CFR 761).

The hierarchy for waste characterization is as follows:

- IDW from an existing wastestream that is known to be designated as non-TSCA waste based on prior characterization: dispose as a solid waste (non-TSCA)

- IDW from an existing wastestream that is known or suspected to be designated as TSCA waste based on prior characterization: dispose as a TSCA-regulated waste
- IDW from an existing wastestream that is known to not be a hazardous waste based on prior characterization, but for which the PCB concentration is uncertain: analyze for PCBs and dispose as TSCA or non-TSCA solid waste based on analytical results
- PPE and similar wastestreams that are unlikely to contain constituents at regulated concentrations: dispose as a non-TSCA solid waste
- IDW from a new wastestream that has not been characterized – analyze for full spectrum of waste characterization parameters, dispose as TSCA or non-TSCA solid waste based on analytical results

IDW will be chemically characterized at one of the laboratories approved for use for the project: KAR Laboratories, Inc. in Kalamazoo, Michigan; TestAmerica in Burlington, Vermont; or other qualified laboratories that conduct sample analysis under USEPA-approved work plans for the Site. Chemical characterization procedures are as follows:

- A composite sample can be collected of similar IDW (e.g., soils and sediments) held in separate drums for chemical characterization. The sample should be analyzed for full toxicity characteristic leaching procedure (TCLP) characterization, including PCBs, and relevant disposal parameters (corrosivity by pH, reactive cyanide, flashpoint, ignitability, percent solids, reactive sulfide).
- Excess soils and sediments may also be characterized by “knowledge of waste” if a current waste characterization profile is available for similar materials that are being disposed offsite under an active removal action/cleanup project. In such a case, no additional chemical characterization is necessary, and the drums of these materials can be disposed at the TSCA or non-TSCA facilities contracted for the specific project.

4. Transportation and Disposal

All IDW will be disposed properly with the appropriate manifests and other documentation under the generator identification number MIK872785936. Facilities pre-approved to treat and receive specific types of IDW from Site activities are as follows:

- General Oil Company facility in Livonia, Michigan: approved to treat water containing low levels of PCBs (i.e., less than 1 ppm)
- Ottawa County Farms Landfill in Coopersville, Michigan: approved for disposal of non-TSCA-regulated solid wastes
- C&C Landfill in Marshall, Michigan: approved for disposal of non-TSCA-regulated solid wastes
- Environmental Quality facility in Wayne, Michigan: approved for disposal of TSCA-regulated solid wastes

5. Recordkeeping

Waste Profiles, Waste Manifests, and Chemical Characterization Paperwork (chain-of-custody forms, laboratory results): Hard copies are stored in a labeled file cabinet at the field office, and electronic copies should be forwarded to the ARCADIS-Syracuse, New York and ARCADIS-Chicago, Illinois offices.

Inventory of Frozen Samples: The field staff will work with ARCADIS-Syracuse staff to keep an up-to-date electronic inventory of samples held in frozen storage in the field office and at the analytical laboratories. Master copies of the inventory are to be maintained in the ARCADIS-Syracuse, New York and ARCADIS-Chicago, Illinois offices.

Inventory of Samples at Analytical Laboratories: An inventory of samples shipped to TestAmerica and KAR Laboratories and held in frozen storage pending a decision to analyze will be maintained by ARCADIS-Syracuse staff. An up-to-date inventory of unused sample material held by the project laboratories will be sent to the ARCADIS-Syracuse, New York and ARCADIS-Chicago, Illinois offices on a quarterly basis.

Inventory Review and Disposal Arrangements: ARCADIS staff will review the inventory of samples held in frozen storage in the field office, IDW held in the field office, and samples held by the project laboratories no less than once every 6 months. Based on that review, arrangements will be made to dispose of IDW and selected frozen samples held at the field office to coincide with field efforts in which IDW is expected to be generated and disposed, when possible. The project laboratories will be contacted with instructions for sample disposal on an ongoing basis, once archived samples are no longer needed to satisfy work plan requirements.

6. Reference

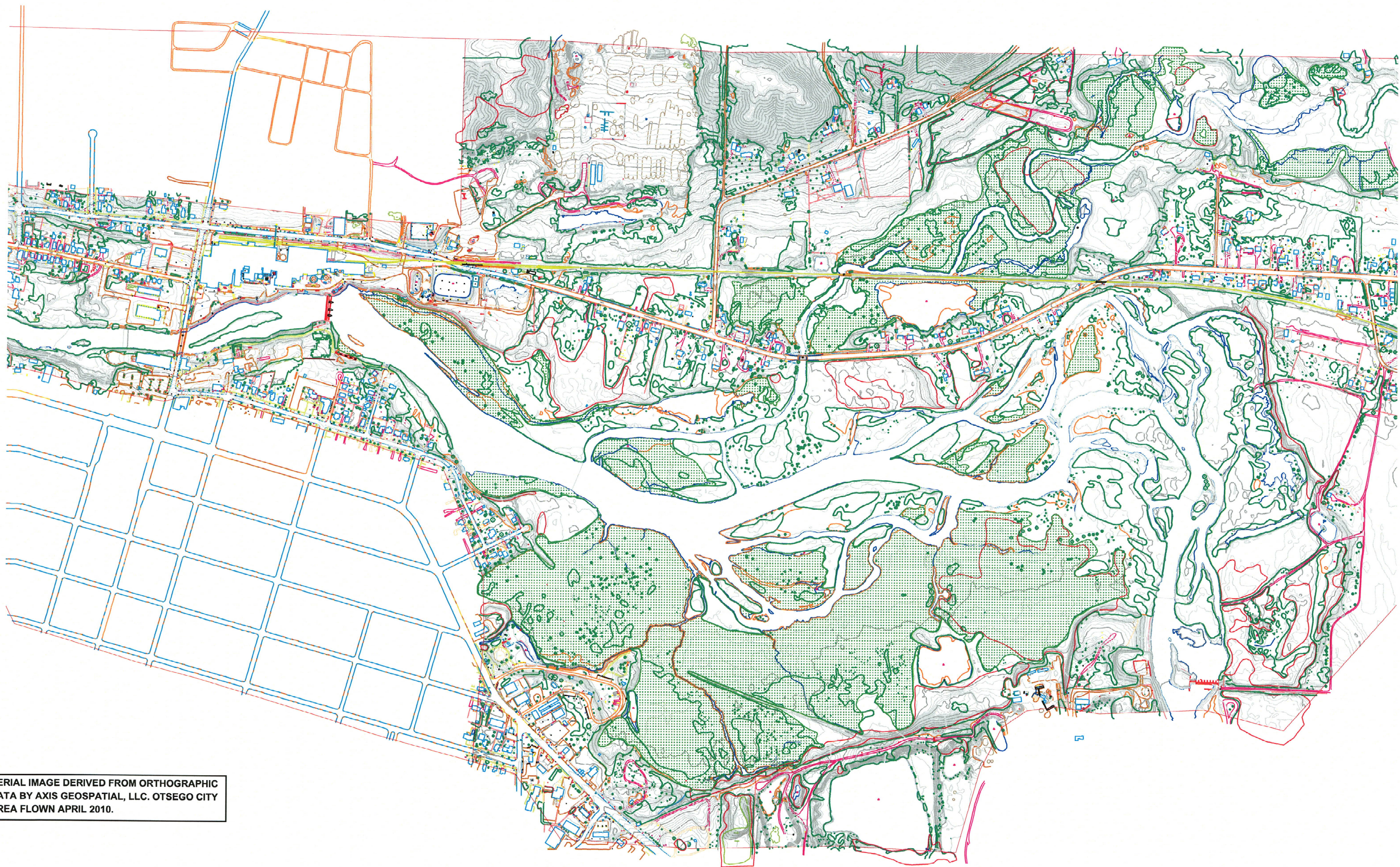
ARCADIS. 2010. Area 2/Otsego City Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan. September 2010.

Appendix B

Axis Geospatial Survey
Information



AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO CITY AREA FLOWN APRIL 2010.



AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC
DATA BY AXIS GEOSPATIAL, LLC. OTSEGO CITY
AREA FLOWN APRIL 2010.

Summary of metadata provided by Axis Geospatial

Project was flown in COLOR on 03-31-2010 at a flight height of 1800' above the mean terrain height (AMT) which creates a negative scale of 1"=300'. There were 3 flight lines and 90 exposures captured.

High resolution scanning of the aerial film was done at a resolution of 15 microns or 1693 DPI

Aero-Triangulation was performed to geo-reference the imagery and resulting adjustments were analyzed to meet accuracy requirements for mapping scale

All data was stereo captured in 3D providing and X, Y, and Z data coordinate value for each point digitized.

Accuracy of data meets or exceeds the National Map Accuracy Standards for 1"=40' w/ 1' contour intervals which for this data is +/- 1' horizontal accuracy and .5' vertical accuracy for contour lines and .33' vertical accuracy for spot elevation.

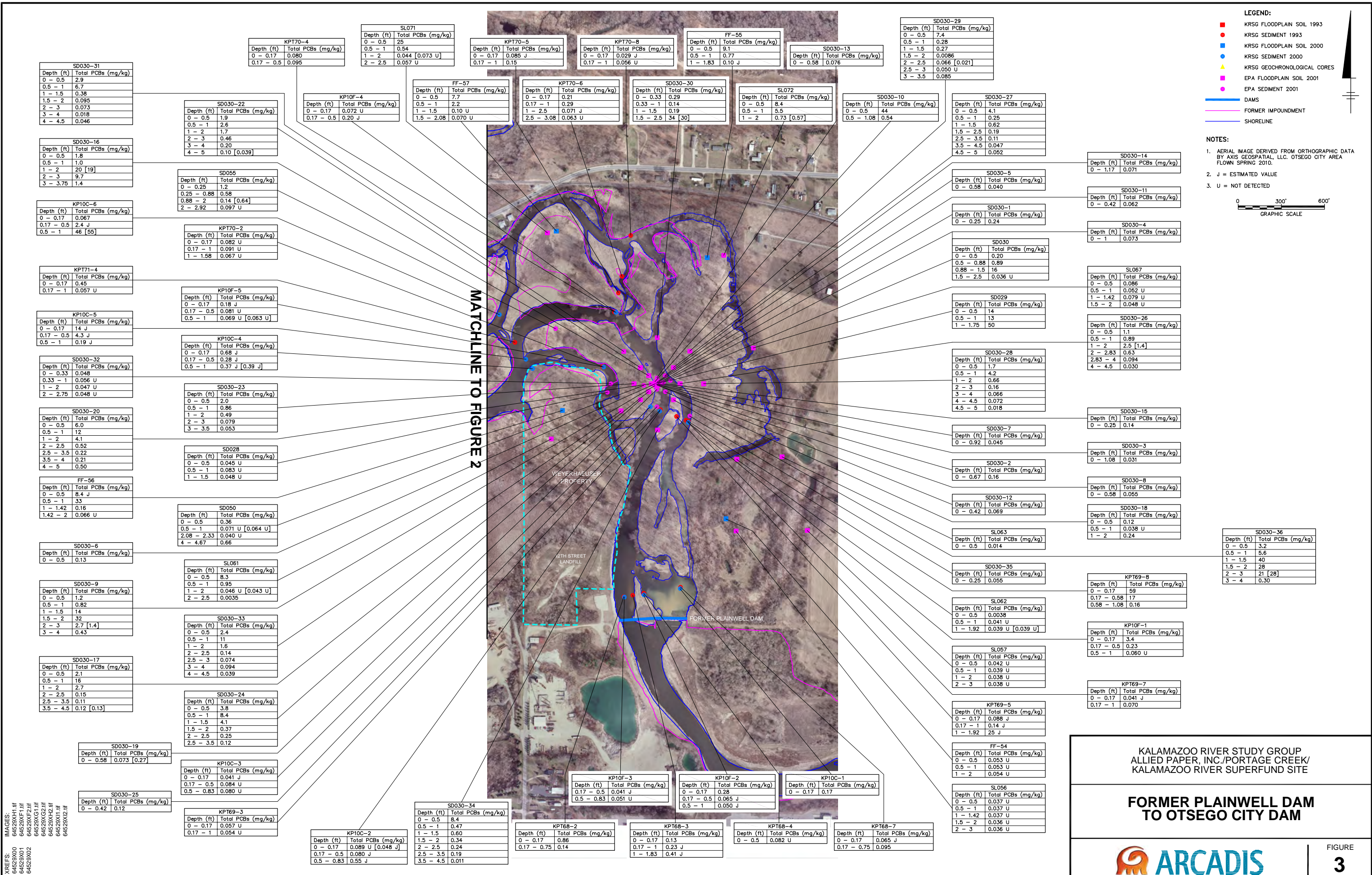
Horizontal Datum: Michigan State Plane, NAD 83 (International feet)

Vertical Datum: NGVD29 (US feet)

Appendix C

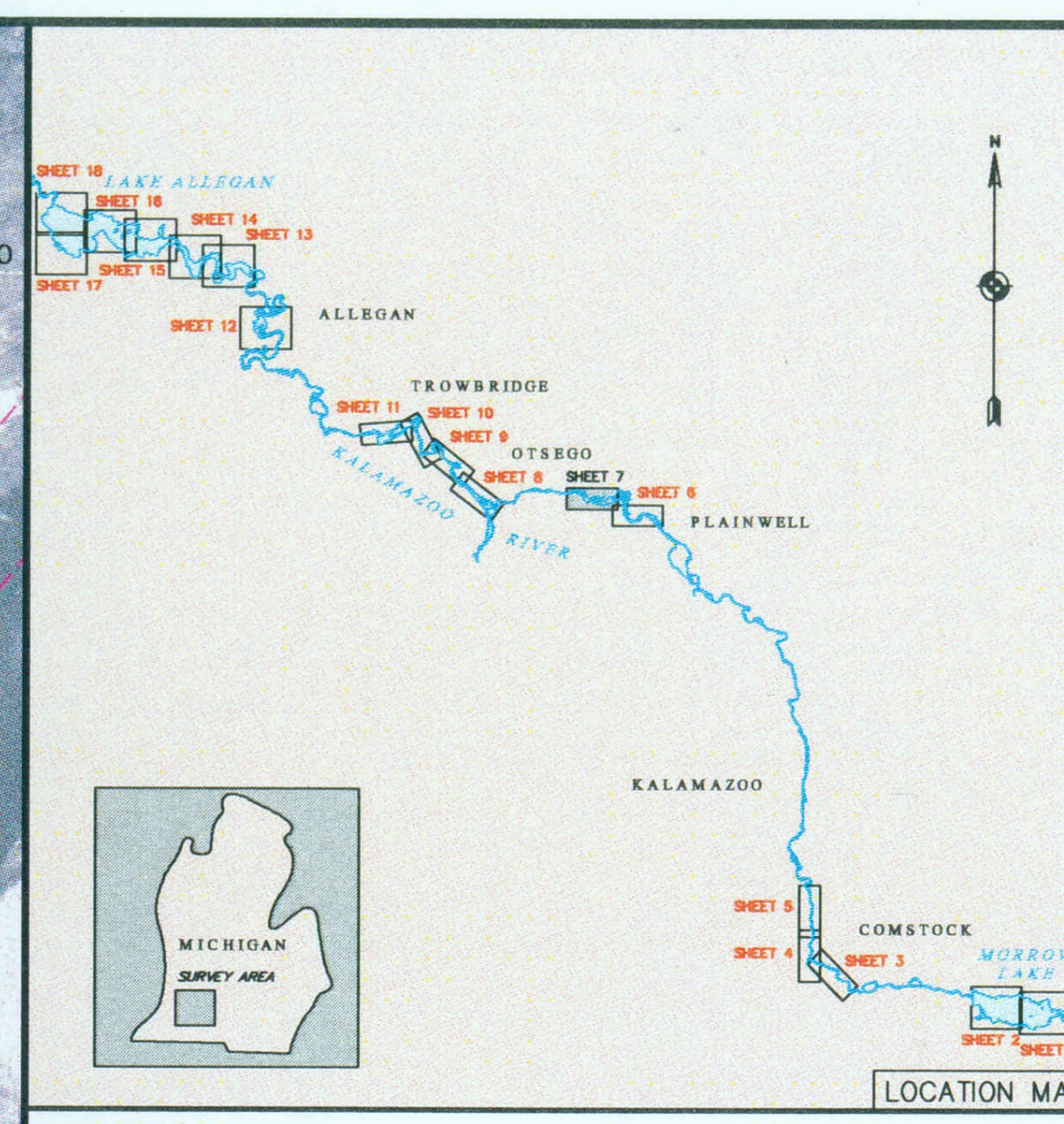
Data Box Maps of Available Soil
and Sediment PCB Data





Appendix D

OSI 2000 Bathymetric Survey
Maps and CD with data



LEGEND

ELEVATION POINT
3333333333
SURVEY VESSEL TACKLINE

ELEVATIONS APPROXIMATE DUE TO SHALLOW SITE CONDITIONS (SEE PROJECT REPORT)

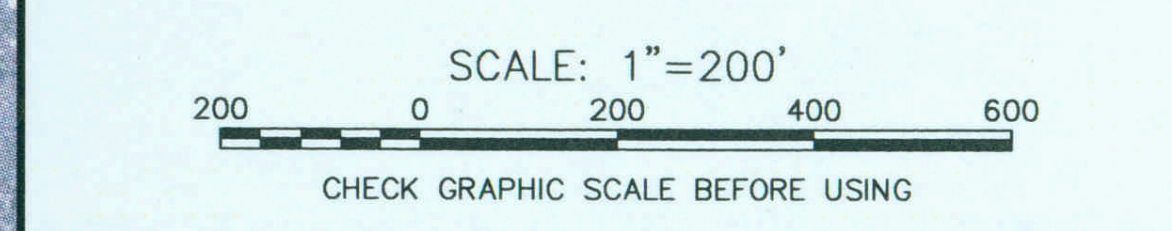
DIGITAL SHORELINE PROVIDED BY CLIENT


KPT-61
EARLIER SURVEY TRANSECT (KPT)

PUSH PROBE AND INTERPRETED SEDIMENT TYPE

- SOFT SEDIMENTS (MUDS TO AQUEOUS SILTS)
- CLAY
- SILTY SAND-SANDY/SILT
- SAND
- SAND & GRAVEL
- ROCKS (COBBLES-BOULDERS & BEDROCK)
- STUMP
- SUBMERGED AQUATIC VEGETATION

- NOTES**
- GRID SYSTEM IS IN FEET AND IS THE MICHIGAN STATE PLANE COORDINATE SYSTEM SOUTH ZONE (2113), NAD 83.
 - ELEVATIONS ARE IN FEET ABOVE NGVD (1929) BASED ON WATER LEVEL CORRECTIONS APPLIED TO SOUNDINGS. WATER LEVELS ARE BASED ON READINGS EITHER MADE BY OSI DURING THE COURSE OF THE SURVEY AT STAFF GAUGES INSTALLED BY LIMNO, INC. OR PROVIDED BY LIMNO-TECH, INC. FOLLOWING THE CONCLUSION OF THE INVESTIGATION, THE DECIMAL POINT INDICATES THE POSITION OF THE ELEVATION.
 - CONTOUR INTERVAL IS 2 FEET. CONTOURS WERE COMPUTER GENERATED USING "QUICKSURF" VERSION 5.2 (SCHEIBER INSTRUMENTS, INC.) OPERATING WITHIN "AUTOCAD" VERSION 14 (AUTODESK).
 - DIGITAL SHORELINE AND THE GEOREFERENCED ORTHO- PHOTOGRAPH PROVIDED BY LIMNO-TECH, INC. DISCREPANCIES IN THE SHORELINE POSITION BETWEEN THE TWO DATA SETS ARE SHOWN. IN THE URBAN KALAMAZOO SECTION OF THE RIVER, THE ORTHOPHOTOGRAPH HAS BEEN ADJUSTED 45 FEET WEST TO BEST-FIT ACTUAL FIELD OBSERVATIONS.
 - SIDE SCAN MOSAIC BASED ON IMAGES ACQUIRED USING A MARINE SONIC TECHNOLOGY, LTD. SEASCAN PC DIGITAL SIDE SCAN SONAR SYSTEM OPERATING AT 600 kHz. THE MOSAIC WAS GENERATED USING SOFTWARE IMAGING PACKAGES CARIS (UNIVERSAL SYSTEMS, LTD.) AND GEO DAS (OCEAN IMAGING CONSULTANTS, INC.). SIDE SCAN SONAR MOSAICS HAVE BEEN GENERATED AT AN APPROXIMATE 0.65 FOOT PIXEL RESOLUTION. AT THIS RESOLUTION, INDIVIDUAL TARGETS SLIGHTLY SMALLER THAN APPROXIMATELY 1.5 FEET CAN BE RESOLVED. AS PROJECT DRAWINGS HAVE BEEN CONSTRUCTED AT A SCALE OF 1"=200' MUCH OF THE SONAR RESOLUTION IS LOST IN THE PLOTTED PRESENTATION. IF ADDITIONAL DETAIL OF A PARTICULAR AREA IS NEEDED, PROJECT DRAWINGS SHOULD BE PLOTTED AT A LARGER SCALE TO ENHANCE RESOLUTION.
 - THE INFORMATION PRESENTED ON THESE DRAWINGS REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 23 JULY-14 AUGUST 2000 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.



OCEAN SURVEYS, INC. 

OLD SAYBROOK, CONNECTICUT

PREPARED FOR: BLASLAND, BOUCK & LEE, INC.

HYDROGRAPHIC/GEOPHYSICAL DATA

KALAMAZOO RIVER
MORROW LAKE TO LAKE ALLEGAN, MICHIGAN
OTSEGO CITY

PROJ. MGR. J.D. SULLIVAN	SURVEY DATE 23 JULY-14 AUG. 2000	SCALE 1"=200'
DRAFTED BY P.J. LACKEY	DATE 11 DECEMBER 2000	DWG. NO. 00ES056

G:\ENV\CAD\SYRACUSE\ACT\B0064529\000\1005000\DWG\2000 OSI Area 2 Bathymetry Data\SHET07.dwg LAYOUT: LAYOUT11 SAVED: 9/27/2010 3:23 PM ACADVER: 18.05 (LMS TECH) PAGES: 10 PLOTTED: 9/27/2010 3:26 PM BY: PETRIE, RICH

OSI PRELIMINARY X,Y,Z SURVEY DATA (21 November 2000)

Kalamazoo River Investigation (Morrow Lake - Lake Allegan)

Files on this disk are grouped by survey area and subdivided by survey day

Explanation of files

-Depth File names

SurveyArea_depth(SurveyDate__process file version).dat

example line in depth file

12797066.2	300655.9	2.8
^Easting	^Northing	!Depth

-Elevation File names

SurveyArea_elevation(SurveyDate__process file version).dat

example line in elevation file

12797156.0	300315.4	748.2
^Easting	^Northing	~Elevation

^Grid coordinates are feet and are referenced to Michigan State Plane, South Zone, NAD83.
!Depth @ time of survey reported in feet, note depth values shown <2.5 feet are an unedited artifact of the depth sounding system in shallow water (<2.5 feet) and should not be used.
~Elevation in feet referenced to NGVD1929 based on water levels provided by Limno-Tech, note elevations calculated for water depths <2.5 feet should not be used.

In each directory there is a ASCII x,y,z file ("SiteName"less2_5.cvs) which contains shallow depth values from the site less than 2.5 feet that have been identified on the project drawing sheets.